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THE MINERALOGICAL MAGAZINE

AND

Journal of The Mineralogical Society

(INSTITUTED FEBRUARY 3, 1876.)

WITH A SEPARATELY-PAGED APPENDIX OF

MINERALOGICAL ABSTRACTS

EDITED BY L. J. SPENCER, F.R.S.

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DE
MINÉRALOGIE ET PÉTROGRAPHIE

Published by the Mineralogical and Petrographical Society of Switzerland. Numbers are issued semi-annually and contain about 200 pages. Among the contributors are all Swiss mineralogists and petrographers and the mineralogical institutes of the Swiss Universities. The papers cover the whole field of crystallography, mineralogy, and petrography, with special reference to the Alps.

Subscription Rates:

Free to members of the Mineralogical and Petrographical Society of Switzerland (annual subscription to the Society 20 frs., applications for membership to be addressed to the Secretary, Prof. Dr. Conrad Burri, Mineralogical Institute, Sonneggstrasse 5, Zürich 6). Subscriptions for non-members (two issues) 25 frs. Remittances to be addressed to

Messrs. Leemann & Co., A.G., Stockerstrasse, Zürich 2.

Back numbers, so far as still available, can be procured from the publishing company.

REFRACTOMETERS

We shall be pleased to send details of the Tully, Rayner, and Anderson-Payne Refractometers to any enquirer and hope that the time will soon come when we shall be able to supply the instruments as readily as we can now supply information concerning them.

RAYNER

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PROCEEDINGS

OF THE

MINERALOGICAL SOCIETY

(1943)

EXCERPT MINUTES OF COUNCIL MEETING

Held in the Apartments of the Geological Society, Burlington House, London, W., January 28, 1943, *at* 2 *p.m.*

Mr. F. N. Ashcroft, President, in the Chair.

Dr. George Tobias Faust, Dr. Michael Fleischer, Dr. Kathleen Lonsdale, and Dr. Frank Smithson were proposed and provisionally elected Ordinary Members of the Society. The deaths were reported of Sir Henry A. Miers, senior Life Member and former President and Trustee of the Society, and of Frau Goldschmidt, widow of Professor Victor Goldschmidt, a former Honorary Member.

Reports were received from the Treasurer and the Editor, and the Treasurer presented the audited accounts for 1942. The question of lectures at the ordinary meetings was considered.

The Foreign Secretary was requested to send a letter of congratulation on behalf of the Society to Dr. A. E. Fersman, Honorary Member, on the award to him of the Wollaston Medal of the Geological Society.

GENERAL MEETING

Held in the Apartments of the Geological Society, Burlington House, London, W., January 28, 1943, *at* 3.15 *p.m.*

Mr. F. N. Ashcroft, President, in the Chair.

Twenty-four Members and eight Visitors were present.

The elections of Drs. G. T. Faust, M. Fleischer, K. Lonsdale, and F. Smithson as Ordinary Members of the Society were confirmed. The President in announcing the death of Sir Henry A. Miers gave an account of Sir Henry's life work. The Members present observed a short silence in his memory.

Mr. C. E. N. Bromehead exhibited a copy of Dioscorides and commented on some of the mineralogical descriptions.

The following papers were read:

1. An X-ray study of diamonds artificially prepared by J. B. Hannay in 1880: by Mr. F. A. Bannister and Dr. Kathleen Lonsdale (vol. 26, p. 315).

2. Notes on some minerals either new or rare to Britain. Part 3: Semseyite from Carnarvonshire: by Mr. Arthur Russell.

EXCERPT MINUTES OF COUNCIL MEETING

Held in the Apartments of the Geological Society, Burlington House, London, W., March 25, 1943, *at* 3.15 *p.m.*

Mr. F. N. Ashcroft, President, in the Chair.

The death of Prof. A. P. Honess was reported. Resignations were received and accepted from Mrs. V. Courtauld and Dr. R. H. Rastall. The names of Mr. C. S. Garnett and Mr. G. Penrose were removed from the List of Members. Reports were received from the Treasurer and the Editor.

GENERAL MEETING

Held in the Apartments of the Geological Society, Burlington House, London, W., March 25, 1943, *at* 4.45 *p.m.*

Mr. F. N. Ashcroft, President, in the Chair.

Twenty-eight Members and eighteen Visitors were present.

A lecture entitled 'Industrial diamond' was delivered by Professor W. T. Gordon. The lecture was illustrated by set and unset diamonds for various industrial purposes and was followed by a discussion in which several members and visitors took part. Professor Gordon also exhibited a collection of diamond crystals including some unusual examples of twinning on the spinel law.

EXCERPT MINUTES OF COUNCIL MEETING

Held in the Apartments of the Geological Society, Burlington House, London, W., June 3, 1943, at 3.30 *p.m.*

Mr. F. N. Ashcroft, President, in the Chair.

Mr. Orlando Hudson Chapman, Mr. Andrew Ford Seager, and Mr. Robert Webster were proposed and provisionally elected Ordinary Members of the Society.

The President reported that the late Sir Henry A. Miers had left to the Society the sum of £200 free of duty and without conditions. Reports were received from the Treasurer and the Editor.

The list of Officers and Council for 1943–4 was considered. The following were to retire: Vice-President, Prof. H. H. Read; Ordinary Members of Council, Mr. E. H. Beard, Dr. L. Hawkes, Dr. N. F. M. Henry, and Miss J. M. Sweet. The following were nominated for election at the Anniversary Meeting on November 4, 1943: as Vice-President, Sir Lewis L. Fermor; as Ordinary Members of Council, Dr. S. E. Hollingworth, Dr. C. E. Marshall, Dr. F. C. Phillips, and Dr. A. K. Wells.

It was agreed that, subject to approval by the Geological Society, the meetings in 1944 would be held on January 27, March 23, June 8, and November 2.

GENERAL MEETING

Held in the Apartments of the Geological Society, Burlington House, London, W., June 3, 1943, at 5 p.m.

Mr. F. N. Ashcroft, President, in the Chair.

Twenty-one Members and seven Visitors were present.

The elections of Messrs. O. H. Chapman, A. F. Seager, and R. Webster as Ordinary Members of the Society were confirmed.

The following papers were read:

1. Notes on the discrimination between pyrope garnet and red spinel: by Mr. B. W. Anderson.
2. The forgotten uses of selenite: by Mr. C. E. N. Bromehead (vol. 26, p. 325).
3. Sixteenth list of new mineral names: by Dr. L. J. Spencer (vol. 26, p. 334).

EXCERPT MINUTES OF COUNCIL MEETING

Held in the Apartments of the Geological Society, Burlington House, London, W., November 4, 1943, at 2.15 p.m.

Mr. F. N. Ashcroft, President, in the Chair.

Mr. Douglas Wallace Bishopp, Dr. Frank Henry Day, Mr. Henry George Dines, Mr. Joseph John Fahey, Mr. Robert Blackadder Fisher, Mr. Paul Grodzinski, Dr. Brian Harold Mason, and Dr. Roy Woodhouse Pocock were proposed and provisionally elected as Ordinary Members of the Society. The death of Mr. D. F. Ashby was announced.

Reports were received from the Treasurer and the Editor. It was decided not to print the Bye-laws and List of Members in the forthcoming number of the *Magazine* commencing a new volume, but to issue them separately. Authority was given for the disposal as salvage of the larger part of the blocks that had been used for illustrations in the *Magazine*, of which a large stock was stored by the printer. A list of 85 blocks to be retained for the present was submitted.

The Secretary read the draft of the Annual Report of Council, which was adopted.

GENERAL (ANNIVERSARY) MEETING

Held in the Apartments of the Geological Society, Burlington House, London, W., November 4, 1943, at 3.30 p.m.

Mr. F. N. Ashcroft, President, in the Chair.

Thirty Members and five Visitors were present.

Major H. J. L. Beadnell and Dr. C. M. Cook were appointed as scrutineers of the voting papers for the election of Officers and Council.

The elections of Messrs. D. W. Bishopp, F. H. Day, H. G. Dines, J. J. Fahey, R. B. Fisher, P. Grodzinski, B. H. Mason, and R. W. Pocock were confirmed.

The General Secretary read the following:

ANNUAL REPORT OF THE COUNCIL FOR 1942–3

Membership.—Including 1 Ordinary Members and 1 Honorary Member resident in enem or enemy-occupied countries, the total membership on October 31 was 266 against 265 o October 31, 1942. Eleven new members have been elected during the year. The Society ha lost by death three members, Mr. D. F. Ashby, Prof. A. P. Honess, and Sir Henry A. Mier Sir Henry, who was the senior member of the Society, was also the sole surviving member o the Crystallological Society through which he entered the Mineralogical Society in 1883. H had held the offices of Editor (1891–1900), Vice-President (1901–1904), President (1904–1909) and Trustee (1911–1940). By his death the Society has lost one of its best friends. Thre members have resigned and the names of two others have been removed from the List o Members on account of arrears in subscription. One election made in 1942 has been declare void. The membership on October 31 consisted of 5 Honorary Members and 261 Ordinar Members of whom 43 were Life Members.

Meetings.—The usual four ordinary meetings have been held during the session 1942–3 the total attendance was 97 members and 43 visitors, representing an average attendance o 35 persons compared with 30 for the previous session. The marked increase in the number o visitors is noted with satisfaction. At these meetings nine papers have been read, one was take as read, a lecture was delivered, and three exhibits were shown.

Publications.—Despite continued limitation of paper supplies and other unavoidabl difficulties, four numbers (178–181) of the *Mineralogical Magazine* have been issued duri the year. These have contained the Proceedings in 10 pages, 13 papers in 94 pages with plates and 10 text-figures, and 480 abstracts in 108 pages.

Financial.—The accounts for the calendar year 1942, published in the March number o the *Magazine* showed an excess of assets (exclusive of the stock of the *Magazine*, certai periodicals, and the securities allocated to the Composition Fees Account) over liabilities o £1685. 3*s*. 2*d*. against £1503. 18*s*. 8*d*. at the close of 1941. The value of the securities standin in the name of the Custodian Trustee on December 31, 1942, was, General Reserv £1243. 18*s*. 2*d*., Composition Fees Account £1180. 17*s*. 11*d*.

The cash at Bankers, in the Post Office Savings Bank, and in hand on January 1, 194 amounted to £295. 17*s*. 7*d*. against £238. 10*s*. 0*d*. at the beginning of 1942. The receipts sinc then from Annual Subscriptions and from the Society's publisher for sales of the *Magazin* have been well maintained, and have, in fact, exceeded expectations. As was the case in 194 the expenditure on the *Mineralogical Magazine* has been considerably restricted, owin *inter alia* to the limitation of paper supplies. The amount receivable from the 218 Annua Subscribers on the Society's books on January 1, 1943, was, as Entrance Fees £2. 2*s*. 0*d*., a subscriptions for 1943 £228. 18*s*. 0*d*., and as arrears £69. 14*s*. 7*d*., in all £300. 14*s*. 7*d*. Of thi sum £16. 16*s*. 0*d*. for 1943 and £42. 8*s*. 7*d*. due as arrears were 'frozen'. After deducting thes sums, the amount receivable was, as Entrance Fees £2. 2*s*. 0*d*., as subscriptions for 194 £212. 2*s*. 0*d*., and as arrears £27. 6*s*. 0*d*. Of the amount payable in respect of 1943 sub scriptions £7. 8*s*. 0*d*. had been received in advance before the beginning of the year.

By October 31, £192. 19*s*. 7*d*. (including the payments in advance of £7. 8*s*. 0*d*.) had bee received in respect of 1943 subscriptions and £16. 16*s*. 0*d*. as arrears, as against £185. 17*s*. 0 and £6. 8*s*. 2*d*. respectively by that date in 1942. Entrance Fees amounting to £9. 9*s*. 0*d*. ha also been received.

During the session the Society has received a legacy of £200 free of duty, bequeathed to i by its former President, the late Sir Henry Miers, F.R.S. This legacy has been added to th Society's General Reserve. A change has also been made in one of the Society's investment In February, on the advice of the Managing Trustees, the Society's holding of £227. 14*s*. 0 Metropolitan Water Board 3 % 'B' Stock was sold. Of this holding £201. 0*s*. 0*d*. Stoc belonged to the General Reserve and £26. 14*s*. 0*d*. Stock to the Composition Fees Account It had been purchased at various times at a total cost of £220. 0*s*. 11*d*. The proceeds of th sale, £221. 10*s*. 6*d*., were invested in 3 % Savings Bonds 1960/70, together with a further sur of £28. 9*s*. 6*d*. £250 of the Bonds were applied for, of which £224. 0*s*. 0*d*. Bonds have bee allocated to the General Reserve and £26. 0*s*. 0*d*. Bonds to the Composition Fees Accoun Strictly it should have been £224. 0*s*. 6*d*. and £25. 19*s*. 6*d*. respectively. In September, whe

Sir Henry Miers's legacy was received, the General Reserve was further strengthened. In addition to the legacy a sum of £100. 0*s*. 0*d*. was invested. £300. 0*s*. 0*d*. 3 % Defence Bonds were applied for.

The cash available for current purposes on October 31 amounted to £445. 15*s*. 4*d*. as against £458. 3*s*. 7*d*. on that date in 1942. As was the case in 1942 the account for the September number of the *Magazine* had not by then been received; nevertheless the figures are not strictly comparable, for no transfers to reserve were made in 1942 as against a total transfer of £128. 9*s*. 6*d*. from current funds in 1943.

The outgoings for the remainder of the year, provided it is possible to settle the account for the December number of the *Magazine* before the close of the year, are estimated at about £220, and the receipts therefor at about £48. On this basis the cash available at the close of the year should be about £273.

General.—The arrangements referred to in the Annual Reports for 1940 and 1941 relative to the transmission of remittances from abroad have been continued and have proved successful.

On the proposal of Dr. K. C. Dunham, seconded by Dr. M. H. Hey, the adoption of the Annual Report was carried unanimously.

A vote of thanks to the Geological Society for the use of its apartments was proposed by Dr. G. F. Herbert Smith, seconded by Mr. G. H. Osborn, and carried with acclamation.

A vote of thanks to the retiring Vice-President and Ordinary Members of Council was proposed by Dr. A. F. Hallimond, seconded by Dr. S. E. Hollingworth, and carried.

The scrutineers reported that 17 ballot papers had been returned and examined and that the following list as nominated by the Council had been approved and were accordingly duly elected.

President. Mr. F. N. Ashcroft, M.A., F.G.S., F.C.S.
Vice-Presidents. Dr. W. F. P. McLintock, D.Sc., F.R.S.E., F.G.S.; Sir Lewis L. Fermor O.B.E., D.Sc., F.R.S.
Treasurer. Dr. A. J. Bull, M.Sc., Ph.D., F.G.S.
General Secretary. Dr. G. F. Claringbull, B.Sc., Ph.D., F.G.S.
Foreign Secretary. Sir Thomas H. Holland, K.C.S.I., K.C.I.E., D.Sc., LL.D., F.R.S.
Editor of the Journal. Dr. L. J. Spencer, C.B.E., M.A., Sc.D., F.R.S.

Ordinary Members of Council

H. W. Anderson, B.Sc., F.C.S.
Dr. C. F. Davidson, D.Sc., F.R.S.E., F.G.S.
Prof. W. R. Jones, D.Sc., M.I.M.M., F.G.S.
H. E. N. Bromehead, B.A., F.G.S.
Dr. J. V. Harrison, D.Sc., F.R.S.E., F.G.S.
H. E. Howling, B.Sc.
Dr. W. Campbell Smith, M.C., T.D., M.A., Sc.D., F.G.S.
R. C. Spiller, M.A.
Dr. S. E. Hollingworth, M.A., D.Sc., F.G.S.
Dr. C. E. Marshall, B.Sc., Ph.D., F.G.S.
Dr. F. C. Phillips, M.A., Ph.D., F.G.S.
Dr. A. K. Wells, D.Sc., F.G.S.

The following papers were read:

1. A recent find of minerals new to Britain: by Dr. A. W. Groves, Dr. W. Campbell Smith, and Dr. M. H. Hey.

2. A method for the analysis of small quantities of sulphantimonites or sulpharsenites: by Dr. M. H. Hey.

Dr. C. T. Trechmann exhibited rock specimens from west of Llanberis, North Wales.

Dr. Brian Mason gave a talk on recent mineralogical research in Sweden and neighbouring countries which he had visited since the beginning of the war.

ABSTRACT OF RECEIPTS AND PAYMENTS

RECEIPTS	£ s. d.	£ s. d.
		GENERAL PUR-
By Balances brought forward from 1942—		
1. At Bankers (*a*) On current account	26 4 2	
(*b*) On deposit account	35 0 0	
2. In Post Office Savings Bank	233 7 8	
3. In Office	1 5 9	
		295 17 7
Entrance Fees		15 15 0
Annual Subscriptions—		
1. Current Year	186 12 7	
2. Arrears	16 16 0	
3. Advance	15 4 3	
		218 12 10
Sale of Publications—		
1. By Publishers, April 1, 1942–March 31, 1943. Sales at subscription rate £183. 5*s*. 0*d*. and other sales £79. 1*s*. 0*d*. less trade discount and commission £72. 3*s*. 3*d*. and distribution charges £10. 9*s*. 4*d*.	179 13 5	
2. By Custodian of Stock, 1943, £7. 11*s*. 4*d*. less distribution charges £0. 15*s*. 8*d*.	6 15 8	
		186 9 1
Advertisement Fees £11. 11*s*. 0*d*. less commission £2. 5*s*. 6*d*.		9 5 6
Interest on Investments including Income Tax recovered—		
1. £693 3½% War Loan, 1952 and after, Inscribed Stock	24 5 2	
2. £105 4% Consolidated Loan, 1957, Inscribed Stock	4 4 0	
3. £100 4% Funding Loan, 1960–90, Inscribed Stock	4 0 0	
4. £201 Metropolitan Water Board 3% 'B' Stock, Inscribed	3 0 3	
5. £89. 10*s*. 0*d*. 3% War Loan 1955–59, Inscribed Stock	2 13 8	
6. £224 3% Savings Bonds, 1960–70	1 13 4	
		39 16 5
Deposit Interest—		
1. Bankers	0 0 6	
2. Post Office Savings Bank	7 9 10	
		7 10 4
Small Receipts		0 4 9
Credit with the Oxford University Press, being payment in advance made in 1942 for Authors' Separate Copies from No. 179 of the Mineralogical Magazine less actual cost thereof		2 6 7
Transfers from other Accounts—		
From Composition Fees Account, being interest on Investments		36 17 2
Ordinary Receipts		812 15 3
Extraordinary Receipts—		
Legacy left by the late Sir Henry Miers		200 0 0
		£1012 15 3

OCIETY

OR THE YEAR ENDING DECEMBER 31, 1943

OSES ACCOUNT

PAYMENTS	£ s. d.	£ s. d.
Printing and distributing the Mineralogical Magazine, Nos. 180–182 (Oxford University Press)—		
1. Printing	164 5 11	
2. Illustrations	8 2 3	
3. Authors' Separate Copies Nos. 180 and 181	6 9 2	
4. Distribution Charges	20 6 2	
5. Postal Wrappers (Renewal of Stock)	13 2 0	
6. Payment in advance in respect of Authors' Separate Copies from No. 182	3 0 0	
		215 5 6
Printing and distributing Notices of Meetings and other annual printing		17 0 0
Miscellaneous printing, not annual—		
1. Secretary's postcards	2 2 3	
2. Treasurer's notices	0 16 0	
		2 18 3
Expenses at Meetings—		
1. Operator of Lantern	2 2 0	
2. Porter	1 0 0	
3. Tea	3 8 6	
		6 10 6
Custodian Trustee's charges		0 11 7
Care and storage of stock of Publications—		
1. Care of stock in London; J. Mugford	1 1 0	
2. Storage of stock in Oxford	2 0 0	
		3 1 0
Editor's Honorarium		50 0 0
Postage—		
1. Hon. Secretary	1 14 0	
2. Editor (not charged)	0 0 0	
3. Hon. Treasurer	4 5 0	
		5 19 0
Foreign Exchange; Control charges and losses on exchange		1 6 6
Small items		0 4 2
Investments—		
1. Purchase of £28. 9*s*. 6*d*. 3% Savings Bonds, 1960–70	28 9 6	
2. Purchase of £300 3% Defence Bonds, 3rd issue (including investment of legacy)	300 0 0	
		328 9 6
Balances December 31, 1943—		
1. Available for future use—		
(a) At Bankers on Current Account	28 14 0	
(b) In Post Office Savings Bank	240 17 6	
(c) In Office	1 17 9	
	271 9 3	
2. In reserve for Mineralogical Magazine No. 183. At Bankers on current account (since placed on deposit)	110 0 0	
		381 9 3
		£1012 15 3

xamined and compared with Vouchers and found correct.

C. N. BROMEHEAD
JAMES PHEMISTER } Auditors

nuary 20, 1944.

A. J. BULL, Hon. Treasurer.

BALANC

DECEMBE

LIABILITIES	£	s.	d.	£	s.
To Annual Subscriptions received in advance—					
1. Received in 1943 for 1944	14	1	9		
2. Received in 1943 for 1945	1	2	6		
				15	4
Sundry Creditors—					
Oxford University Press for No. 183 of the Mineralogical Magazine. Estimated cost thereof				110	0
Excess of Assets over Liabilities				1912	10
				£2037	14

COMPOSITION FEES ACCOUN

RECEIPTS	£	s.	d.	£	s.
By Composition Fees received as per last account				1223	5
Interest on Investments including Income Tax recovered—					
1. £992 3½% War Loan, 1952 and after, Inscribed Stock	34	14	4		
2. £26 3% Conversion Loan, 1948–53, Inscribed Stock	0	15	6		
3. £26. 14*s.* 0*d.* Metropolitan Water Board 3% 'B' Stock, Inscribed	0	8	0		
4. £25. 18*s.* 0*d.* 3% War Loan, 1955–59, Inscribed Stock	0	15	6		
5. £26 3% Savings Bonds, 1960–70	0	3	10		
				36	17
				£1260	2

HEET

, 1943

ASSETS	£ s. d.	£ s. d.
Balances—		
1. At Bankers on Current Account	138 14 0	
2. In Post Office Savings Bank	240 17 6	
3. In Office	1 17 9	
		381 9 3
Sundry Debtors—		
1. Publishers (Oxford University Press)		
(a) For Sale of Publications, April 1–December 31, 1943	74 13 1	
(b) For Advertisement Fees, April 1–December 31, 1943	7 2 7	
2. Income Tax recoverable	1 13 4	
		83 9 0
Investments at Brokers' Valuation—		
1. £693 3½% War Loan, 1952 and after, Inscribed Stock at 103⅜%	716 7 9	
2. £105 4% Consolidated Loan, 1957, Inscribed Stock, at 110%	115 10 0	
3. £100 4% Funding Loan, 1960–90, Inscribed Stock at 113½%	113 10 0	
4. £89. 10*s*. 0*d*. 3% War Loan, 1955–59, Inscribed Stock at 101½%	90 16 10	
5. £300 3% Defence Bonds, 3rd issue, at par	300 0 0	
6. £224 3% Savings Bonds, 1960–70, at par	224 0 0	
		1560 4 7
Annual Subscriptions in arrear (£83. 12*s*. 0*d*. including £59. 4*s*. 7*d*. due from enemy and enemy-occupied countries) estimated to realize		10 10 0
Entrance Fees in Arrear		2 2 0
		£2037 14 10

Note:—The value of the periodicals retained after the disposal of the Library, that of the sold stock of Publications, and the securities allocated to the Composition Fees Account e not included in the above Assets.

January 20, 1944. A. J. BULL, Hon. Treasurer.

EAR ENDING DECEMBER 31, 1943

PAYMENTS	£ s. d.	£ s. d.
Investments as per last account—		
1. £992 3½% War Loan, 1952 and after, Inscribed Stock, valued by Brokers at £1025. 9*s*. 7*d*. (103⅜%), at cost	1144 5 6	
2. £26 3% Conversion Loan, 1948–53, Inscribed Stock, valued by Brokers at £26. 18*s*. 10*d*. (103⅝%), at cost	26 9 6	
3. £26. 14*s*. 0*d*. Metropolitan Water Board 3% 'B' Stock, Inscribed, at cost	26 5 0	
4. £25. 18*s*. 0*d*. 3% War Loan, 1955–59, Inscribed Stock, valued by Brokers at £26. 5*s*. 9*d*. (101½%), at cost	26 5 0	
		1223 5 0
Less £26. 14*s*. 0*d*. Metropolitan Water Board 3% 'B' Stock, sold for £25. 19*s*. 6*d*., at cost		26 5 0
		1197 0 0
Add £26 3% Savings Bonds, 1960–70, acquired with the proceeds of the above sale, valued by Brokers at par, at cost of previous investment		26 5 0
		1223 5 0
Income transferred to General Purposes Account		36 17 2
		£1260 2 2

xamined and compared with Vouchers and found correct.

C. N. BROMEHEAD
JAMES PHEMISTER } Auditors.

January 20, 1944. A. J. BULL, Hon. Treasurer.

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Notes on some minerals either new or rare to Britain.

(With Plate I.)

By Sir Arthur Russell, Bart.

[Read January 23, 1941, June 5, 1941, and January 28, 1943.]

1. *Gold nugget from Leadhills, Lanarkshire.*

On June 6, 1940, Mr. John Blackwood of Leadhills, while searching for gold in the alluvial wash at the head of the Shortcleuch Water, Leadhills, Lanarkshire, a spot which has for many years been the happy hunting ground of Mr. Blackwood and John D. Weir, Leadhills' two most persistent and successful gold winners, was lucky enough to discover a water-worn mass of gold in quartz weighing 501·2 grains, by far the largest and richest specimen that has been found within the memory of those living in the district. The specimen (plate I) was found while removing a mass of rock at a depth of about 3 feet, the exact spot being a few yards from the east bank of Shortcleuch Water, about midway between the ruined Lowther Cottage (wrongly shown on the six-inch Ordnance map, Lanarkshire 49 NE., as Lauder Cottage) and the junction with the Windgate Burn (Windgate Foot).

Alluvial gold is said to have been first discovered in the Leadhills–Wanlockhead district in the reign of James IV of Scotland, 1488–1513, and there are records of its being worked between 1511 and 1513, the subsequent operations affording a fascinating chapter in the history of British mining. Both Shortcleuch and its tributary the Windgate Burn were the scene of operations by Sir Bevis Bulmer between the years 1578 and 1592 and again in 1603, and the present specimen was found in one of the small patches of ground which had apparently escaped the attention of successive generations of gold seekers.

The gold of the Leadhills–Wanlockhead district occurs in alluvial clay, gravels, and silt bordering the streams, forming terraces, and filling depressions on the lower slopes of the hills which are formed of Ordovician slates and grits. As typical of the occurrence, a terrace of small extent worked by John D. Weir in 1936 on the west side of the Windgate Burn at its junction with the Dun Grain Burn afforded 12 to 15 inches of gold-bearing silt resting upon slaty rock, and overlain by about 5 feet of gravel with occasional large boulders. Accompanying the gold are nodules of limonite up to one inch or more in size, the only other heavy minerals met with being pellets of cerussite and pyromorphite derived from the disintegration of neighbouring lead veins. Practically every bucket full of the silt yielded a minute grain or two of gold. The gold here is as a whole coarse, though as the method of recovery employed is a crude arrangement of launders with riffles and grating, it fails to collect any fine or float gold.

The specimen forming the subject of these notes is now, thanks to the kindne of Mr. Blackwood, in the writer's possession. It consists of a water-worn, thoug still in part crystallized mass of slightly yellowish stained quartz measurin $4 \times 3 \times 1\frac{1}{2}$ cm. thickly coated on one side and to a slight extent on the other wit massive gold rising to form a solid tongue in one corner. The proportion of go to quartz is probably rather less than half by weight, practically the whole c the gold being on the exterior of the mass of quartz and hardly penetrating i The gold shows marked signs of attrition, and it is evident that much more go was originally attached and has been loosened and removed by attrition, th shape and size of the still adhering portions being a counterpart in every way t the small nuggets or pellets usually found in the district, thus affording a dire proof, if proof were wanted, that the whole of the alluvial gold here is deriv from quartz veins.

In concluding this note I should like to pay tribute to the perseverance an skill shown by Messrs. Weir and Blackwood in their years of gold seeking, whi if not particularly remunerative, at any rate presents an extraordinary fasci tion and one which in happier times the writer has shared.

For the beautiful photographic reproduction (pl. I) of the specimen I am indebted to Dr. A. J. Bull, who as will be seen has attained remarkable succes with so difficult an object.

2. *Gold on Russellite from Castle-an-Dinas wolfram mine, St. Columb Major, Cornwall.*

During a recent minute examination of several hundreds of pellets of pure an impure russellite which had been recovered from the jigs concentrating th wolframite at this mine in July 1934, two pellets of comparatively pure russellit about the size of split peas were found to show on their rounded surfaces bleb of bright gold easily visible to the naked eye. One pellet shows two and the othe a larger single bleb $\frac{3}{4}$ of a millimetre in diameter. In addition to the gold there are also embedded in the russellite, quartz and minute brushes of black tourmaline These pellets of russellite were derived from wolfram ore coming from a stope between no. 1 and no. 2 levels in slate (killas) as described in the pages of thi magazine.[1]

The occurrence and association at Castle-an-Dinas is particularly interesting since there is one reliable record only of visible gold having previously been found in a lode in Cornwall. This was at Wheal Sparnon, Redruth, where a single specimen showing minute particles of gold scattered over quartz was picked up on a dump by John Garby in 1844.[2] The dump was derived from a cross lode in slate which yielded much smaltite associated with native bismuth and fluorite Garby was a competent mineralogist and tested the gold, so the occurrence may be looked upon as authentic. The specimen was presented by him to the Penzance Museum where, however, it cannot now be traced, although a most careful search was made on my behalf by Mr. W. P. Simmons, the Curator.

[1] M. H. Hey and F. A. Bannister, Russellite, a new British mineral. Min. Mag., 1938 vol. 25, pp. 41–55.

[2] J. Garby, Notice of the occurrence of gold in a cross-course in Cornwall. Trans. Roy Geol. Soc. Cornwall, 1846, vol. 6, p. 266.

3. *Realgar and Arsenolite from Cornwall.*

The occurrence of large masses of native arsenic in ophitic dolerite (greenstone) in the Burraton Combe quarry, St. Stephen's by Saltash, Cornwall, was described by myself in 1924.[1] Since then, on examining some further specimens discovered with the original material in 1922, one was found to show small though very definite quantities of realgar, a mineral which has hitherto not been recorded from Great Britain.

The realgar occurs as small aurora-red crystalline patches and long prismatic crystals up to $1\frac{1}{4}$ mm. in length embedded in cleavage masses of calcite resting directly upon a reniform mass of native arsenic upon which is also a good deal of arsenolite, yellowish dolomite, and small prismatic crystals of quartz. The prismatic crystals are too rough to afford measurements; they are vertically striated and show distinct cleavage parallel to *b* (010), the prism zone being obviously a combination of (010) and (110).

In describing the occurrence of the native arsenic it was mentioned that traces of arsenolite were present. Among the further specimens which I obtained, two show hollow rounded surfaces in the native arsenic which are more or less completely filled with a thick crust of creamy-white to in part slightly yellowish botryoidal arsenolite. Under the microscope the spheres are seen to be composed of minute flaky crystals with irregular fretted boundaries and a pearly lustre. From some of the spheres project stalactites and delicate branching threads studded with extremely minute octahedra. Heated in a closed tube the arsenolite sublimes completely and redeposits as minute octahedra.

Always a rare substance in the natural state, one of these specimens is a remarkably fine example of the mineral. The only other record of the occurrence of arsenolite in the British Isles is that given by R. P. Greg and W. G. Lettsom in 1858, who state that it was found as acicular crystals filling cavities in masses of smaltite from Wheal Sparnon, Redruth, Cornwall, and occasionally investing ores of cobalt at other localities. No specimens either from Wheal Sparnon or any other British locality are, however, known to me.

4. *Orpiment from Clevedon, Somerset.*

It is a curious fact that although specimens of orpiment from a British locality have been preserved for over sixty years in two provincial museums, no reliable record of its occurrence as a British species has hitherto been made.[2] The follow-

[1] A. Russell, A notice of the occurrence of native arsenic in Cornwall, &c. Min. Mag., 1925, vol. 20, pp. 299–304.

[2] In the year 1860 Mr. Alphonse Gages of Dublin contributed a short paper entitled 'On the formation of orpiment in a mass of sulphate of barytes, found interstratified in the carboniferous limestone near Silvermines, County of Tipperary'. Journ. Geol. Soc. Dublin, 1860, vol. 8, pp. 243–244 and p. 246. This contains the very unconvincing statement that a mass of sulphate of barytes, coloured by sesquioxide of iron, and traversed by a series of filiform veins of galena and arsenical iron pyrites showed a slight coating of orpiment here and there, some of which was produced by a treatment with dilute hydrochloric acid. The specimen came from the old workings in the townland of Ballynoe, Silvermines. Of orpiment I have failed to find a trace at Ballynoe, although in the adjoining townland of Ballygown South traces of a bright yellow coating occur on some of the barytes-hemimorphite-ochreous vein-stuff. This coating contains cadmium and results from the alteration of cadmiferous blende. Similar coatings from other localities have usually been amused to be greenockite; Mr. F. A

ing particulars are all I have been able to glean with regard to a find of thi mineral which is both interesting and mysterious and which for the present a any rate remains an enigma. Some time prior to his death on May 30, 188 Mr. W. W. Stoddart, F.G.S., F.C.S., F.I.C., Public Analyst for the City of Brist and County of Gloucester, of Sneyd Park, Bristol, and an original member o the Mineralogical Society, presented to the City of Bristol Museum specime of orpiment which, according to the label in his handwriting, he had obtain along with a small quantity of realgar from alluvial clay at the Clevedon Bri and Tile Works, Clevedon, Somerset. There is also in the museum at Weston super-Mare a single exactly similar specimen labelled Clevedon, but with particulars as to the donor, but which it seems probable was also presented Mr. Stoddart. The date of Mr. Stoddart's discovery of this orpiment wou appear to have been between the years 1877 and 1880, as the mineral is n mentioned in a paper which he published in 1877 entitled 'Notes on the meta found near Bristol', which includes Clevedon as a locality for malachite, &c. On my informing Dr. F. S. Wallis, the Deputy Director of the Bristol Museum of my interest in this orpiment, he most kindly placed one of the small masse at my disposal at the beginning of 1940. Since then all of the remainin specimens along with the whole of the Bristol Museum's valuable collection o minerals have been entirely destroyed by German bombing, and there remai of this orpiment but two small pieces, the one in my possession and the other i Weston-super-Mare Museum. All of the specimens were precisely similar an consisted of small lemon-yellow foliated masses of pure orpiment, some having little adhering grey clay, the piece in my possession measuring $2 \times 1\frac{1}{2}$ cm., tha in the Weston-super-Mare Museum being a little larger. None of the realga which, according to Mr. Stoddart's label, accompanied the orpiment in sma amount, appears to have been preserved.

The Clevedon Brick and Tile Works are situated three-quarters of a mil south-west of Clevedon station on the west side of, and directly adjoining th Strode road (six-inch Ordnance map Somerset 4 S.E.). In March of 1941 i company with Sir Lewis Fermor I visited the brick works and we were able t make a careful examination under the guidance of the manager, Mr. A. J. May who went out of his way to afford us information. Clay has been dug here fo at least a hundred years, the area occupied by the old pits covering several acre At present one large pit is in operation although at the time of our visit it wa partially filled with water. In no case, even in the past, has clay been dug at greater depth than 10 or 11 feet. The pits lie very near the northern edge of th extensive alluvium flat which stretches between Clevedon and Bridgwate while at Clevedon itself an at first narrow, but gradually widening range of hil of Old Red Sandstone and Carboniferous Limestone with pockets of Dolomit Conglomerate, extends from the mouth of the Severn to Bristol. The clay, whic is obviously not older than Pleistocene and possibly of post-Pleistocene age, ha a uniform grey colour, is full of small hollows left by decayed rootlets, an

Bannister tells me, however, that X-ray photographs which he has taken of exactly simil material from Mill Close mine, Derbyshire, although containing cadmium do not give t greenockite pattern.

[1] W. W. Stoddart, Notes on the metals found near Bristol. Proc. Bristol Naturalists' So 1877, new series, vol. 2, pp. 68–76.

contains numerous minute fresh- and brackish-water shells and also shells of the oyster all indicating salt marsh or estuarine conditions. Mr. May also on one occasion found bones of the ox and the lower incisor tooth of a pig, both of which he presented to me. In addition to the organic remains, small pellets and cleavage masses of calcite not much corroded, up to 1 cm. in size, are fairly plentiful.

The occurrence of orpiment in a Pleistocene clay under the conditions described is so remarkable that one would have been inclined to doubt its authenticity were it not for the fact that Mr. Stoddart was besides being a highly qualified chemist an enthusiastic investigator of local minerals; moreover a microscopic examination of the clay adhering to the specimen in my possession shows a complete similarity to that of the Clevedon Brick Works. On being shown a specimen of the orpiment, the oldest clay worker stated that he had never noticed anything of the kind while digging, his experience, however, going back only some forty years.

Speculation as to the origin of this orpiment is perplexing. Orpiment occurs in clay at several foreign localities, notably at Tajowa in Hungary, but always under conditions more or less explicable. That the Clevedon mineral was formed *in situ* seems highly improbable; and almost equally unsatisfactory is the supposition that it was derived from a mineral vein in the adjacent limestone or Dolomitic Conglomerate, for though a very soft mineral it shows no signs of attrition. In the latter connexion it may be mentioned that both galena and baryte with a little malachite and chessylite occur in Dolomitic Conglomerate exposed in the old quarry near Clevedon pier. Another possibility has suggested itself that the orpiment is a relic of Roman usage, for it is well known that the mineral was utilized as a pigment by that people under the name of auripigmentum.[1] Beyond the fact, however, that there are remains of the Roman occupation in the district I have been unable to find evidence of any such antiquities having been found in the immediate vicinity of the brick works, though curiously enough some years ago during the exploration of the well-known Wookey Hole cave in the Mendips, by Mr. H. E. Balch, a vessel was found containing a small quantity of fine red powder which Dr. J. Newton Friend[2] subsequently proved to be realgar. The vessel containing the realgar was found in the Roman layer in the cave, and is now preserved along with its contents in the Wells Museum.

My thanks are due to Dr. F. S. Wallis of the Bristol Museum, to Mr. W. H. S. Roberts of the Weston-super-Mare Museum, and to Mr. A. J. May of the Clevedon Brick Works, all of whom have afforded me help in trying to unravel the mystery of this occurrence.

5. *Semseyite from Carnarvonshire.*

There is in the extreme north-east corner of Carnarvonshire a small and long-forgotten antimony mine which as far as I can ascertain has never been mentioned in any literature. The mine Bwlch is situated on the eastern flank of a small hill

[1] The Natural History of Pliny. John Bostock and H. T. Riley, 1898, vol. 6, pp. 104–105. Auripigmentum (orpiment) 'A mineral dug from the surface of the earth in Syria, and much used by painters'.

[2] J. Newton Friend. Realgar in Wookey Hole, Somerset. Nature, London, 1937, vol. 139, p. 72.

210 yards north-west of Bwlch farm, Deganwy, near Conway. My attention to it was first awakened many years ago by two old specimens of stibnite in the Museum of Practical Geology which are labelled Castell Deganwy, suggesting that there must have been a mine in that neighbourhood. In 1938 during the turning out of some duplicate or inferior specimens in the collection belonging to the museum of the Royal Geological Society of Cornwall at Penzance, I chanced to notice three specimens bearing old labels in the same handwriting 'Antimony from Bwlch mine, Conway. W. Parry.' Here was the information needed in order to find the exact whereabouts of the mine, and accordingly in 1940 I visited Deganwy and after considerable inquiry succeeded in locating the old working, the position of which has already been indicated. It is shown on the six-inch Ordnance map, Carnarvon 5 NW. (1919), as Trial Shaft.

At what date this mine was worked I have been unable to ascertain, but it was evidently prior to 1864, the date of Sir Warington W. Smyth's catalogue of the original Museum of Practical Geology collection, and judging from the labels on the Geological Society of Cornwall specimens the date was much earlier. W. Parry was probably one of the Parrys of whom there were several generations connected with the Halkyn district mines.

The workings consist of a single shaft, still open on the flank of the hill. This shaft is sunk on the vein and has a short shallow open-cut and adit leading to it. There are said to be two levels driven from the shaft in addition to the adit. The only dump is that around the shaft, and from its small size the workings can have been only on a very small scale. A little farther north on the same hill there are indications of two further slight trials. The direction of the vein, which cannot now be seen, is apparently east and west, the enclosing rock being an ophitic dolerite with Carboniferous Limestone in the immediate vicinity: A good deal of the igneous rock is in the form of spheroidal concretions. The vein filling consists of quartz and chalcedonic chert, often in globular aggregates, with here and there patches of stibnite and what is more interesting the quite rare mineral semseyite. Stibiconite, bindheimite, blende, galena, pyrite, ankerite, anglesite, and baryte are also present in small quantities. The minerals here described were, with the exception of five specimens, obtained by digging into the old dump.

Semseyite ($9PbS.4Sb_2S_3$, monoclinic) occurs both massive and crystallized, its colour being steel-grey to iron-black. When massive it shows small quite well-defined cleavages parallel to (111) and forms patches up to 3 cm. in diameter in white quartz along with stibnite and a little yellow blende. Of the three specimens collected by W. Parry, one has proved to be semseyite and consists of a somewhat granular mass 6×4 cm. intergrown with yellow blende and externally altered to a brownish-yellow crust of bindheimite, grey drusy quartz being also present.

Of the crystallized mineral only one really good specimen was found after an extended search. This shows a cavity $4 \times 2\frac{1}{4}$ cm. in quartz lined with small colourless prismatic crystals of that mineral upon which are numerous, though for the most part confusedly aggregated, crystals of semseyite. These crystals attain a length of 2 mm. and are simple combinations of the forms (001), (100), and (112). They are of flat prismatic habit and are elongated in the direction of the *c*-axis, the (112) faces being deeply striated parallel to their intersections with (001), and both corners and edges are more or less rounded. This habit is exactly similar to that of semseyite from Wolfsberg, Harz, described and figured

Dr. L. J. Spencer;[1] the crystals are, however, more elongated than those shown him. Unfortunately the crystals are, with one or two exceptions, invested th a resinous honey-yellow crystalline crust the surface of which in part has e appearance of liquid gum. This crust is obviously an alteration product ied to or identical with bindheimite, and in some cases sections of broken mseyite crystals show that partial alteration to this substance has extended roughout, while in a few cases the transformation is complete leaving hollow eudomorphs; the same substance also invests the quartz crystals to a lesser gree. One or two crystals terminated at both ends are bare of this crust and ll grey in colour and show the characteristic striations; the faces are, however, o rough and dull to admit of satisfactory measurements, although sufficiently od to enable the forms to be identified. The characteristic habit, the colour, d the presence of lead, antimony, and sulphur at once indicated the mineral be semseyite, and this was definitely confirmed by an X-ray photograph which r. F. A. Bannister most kindly took.

On two specimens the spaces between the semseyite crystals contain very inute hair-like filaments of a grey metallic mineral either stibnite or jamesonite lumosite); these also are in some cases completely altered to an almost colourless d pale yellow crystalline mineral. A single small colourless crystal of anglesite as observed in one cavity in the semseyite. The only other known British cality for semseyite is the Glendinning antimony mine, Westerkirk, Dumfries-ire, where the mineral was discovered by myself in 1918 and described by r. G. F. Herbert Smith in the pages of this magazine.[2]

Of the other minerals occurring in Bwlch mine the stibnite forms typical arsely bladed masses in quartz, one of the two specimens in the Museum of ractical Geology being free from admixture and of several pounds weight. The ecimens obtained from the old dump often have their exterior altered to a in yellow resinous crust of stibiconite. More rarely the stibnite forms rosettes radiating prisms in quartz, the small associated bipyramidal quartz crystals aving included bent rods of stibnite. Galena is rare, cavities in it occasionally ow very small bright octahedra. Blende is present in small quantity, of a ddish-brown colour and as minute crystals. A little granular pyrite was served. Baryte appears to be rare, a single specimen only was found: this ows ordinary white lamellar baryte and strings of small parallel colourless bular crystals up to 4 mm. on drusy quartz, the forms observed by measure-ent being (001), (110), (102), and (011). Small rhombs of ankerite were also ted.

I must here express my thanks to Mr. Gordon Simcox, the owner of Bwlch rm, for most kindly aiding me in my examination of the locality.

6. *Dundasite from Wheal Rose, Sithney, Cornwall.*

In 1937 my friend the late Dr. R. W. T. Gunther of Oxford acquired an old llection of minerals, rocks, and fossils which had for nearly a hundred years in hidden in the Literary and Scientific Institute at Frome in Somerset. The llection was formed by Lady Elizabeth Anne Coxe Hippisley (17 –1843) of

[1] L. J. Spencer, Plagionite, heteromorphite and semseyite as members of a natural group of inerals. Min. Mag., 1899, vol. 12, pp. 55–68, fig. 2, p. 59.

[2] G. F. Herbert Smith, Semseyite from Dumfriesshire. Min. Mag., 1919, vol. 18, pp. 354–359.

Stone Easton Park, Radstock, Somerset, and on the death of Dr. Gunther it passe into my possession. Among several interesting contributors to it was Sir Humph Davy, who presented a small number of Cornish specimens apparently abo the year 1810. One of these bears Lady Hippisley's characteristic neat form label which reads 'Galena with yellow oxide of iron & white carbonate of le Wheal Rose. D', the D standing for Davy; it consists of a mass of coarse cleav galena with a few spots of chalcopyrite and a little yellow ochreous limon One side of the specimen is occupied by a shallow cavity lined with small tabu twinned crystals of cerussite upon which are plentifully sprinkled spheres a tufts of snow-white dundasite, some bipyramidal crystals of quartz being a present. The dundasite spheres are typical of the mineral and are built up minute silky radiating acicular crystals.

Another specimen contained in a small collection of Cornish minerals wh had belonged to Miss Morshead of Treniffle near Launceston came into possession in 1913. It shows characteristic spherical aggregates of snow-wh or slightly yellow stained dundasite on a layer of quartz with slender prisma crystals of cerussite, bipyramidal crystals of quartz, and yellow ochreous limonit upon somewhat blackened galena with a good deal of chalcopyrite. Though n labelled, this specimen almost certainly also came from Wheal Rose, which h produced a number of interesting lead minerals including anglesite, phosgenit laurionite, paralaurionite, cerussite, and pyromorphite.

7. *Dundasite from Port Quin antimony mine, St. Minver Highlands, Cornwall*

This small and long-forgotten antimony mine is situated in a field 750 yard south of Port Quin village about midway between the road and the strea (six-inch Ordnance map, Cornwall 19 NW., on which, however, it is not marked A small dump on the high ground marks the site of a shaft and a little farthe east an adit level has been driven in from the side of the valley and presumabl communicates with the shaft. The only information which I have been able t glean respecting this mine was obtained during my first visit to the spot in 1907 An old resident of Port Quin named John Hawke, then eighty years of age informed me that it was worked by one Francis Kate about the year 1857 an that the lode had a north-east direction and was about 2 feet wide traversin slate (killas). The dump yields abundant jamesonite often superficially altere to bindheimite, the cavities in which contain small crystals of anglesite an minute octahedra of senarmontite, the other minerals found there being a litt galena, blende, chalcopyrite, tetrahedrite, and spots of malachite and cerussite with much quartz, chalybite, limonite, and very rarely dundasite of which tw specimens were found. These show minute snow-white or slightly bluish spherica aggregates of silky radiating acicular crystals on brown cellular limonite wit botryoidal brownish iron-stained allophane and a little cerussite. The presenc of allophane recalls a similar association at three of the other British localitie for dundasite: Welsh Foxdale mine, Trefriw, Carnarvonshire; Gorlan mine Trefriw, Carnarvonshire; and Clements lead mine, Carrowgarriff, Maam, Co Galway.

8. *Dundasite from Cyffty mine, Trefriw, Carnarvonshire.*

In May 1920 I received from my friend the late G. J. Williams, H.M. Inspecto

of Mines for North Wales, a remarkably good specimen of dundasite which he had just found in Cyffty mine. This mine, now abandoned, is in the same neighbourhood as Welsh Foxdale or Pandora mine, the original British locality for dundasite, and was worked on a galena-blende lode traversing slate. The specimen consists of an angular fragment of black slate upon which are rhombohedral casts in greyish quartz and some blende and marcasite, both the quartzose casts and the slate being studded with long acicular crystals of cerussite upon which are numerous snow-white spheres of dundasite up to 1 mm. in diameter.

9. *Dundasite from Gorlan mine, Trefriw, Carnarvonshire.*

A specimen collected in this mine by Mr. G. J. Williams in 1921 during its last working, and which I received from him, consists of the following assemblage of minerals. Dundasite as a snow-white downy crust of very minute matted silky needles on gum-like brownish-yellow allophane which envelops prismatic crystals of cerussite and bipyramidal crystals of quartz, associated with small colourless crystals of anglesite, on galena, blende, radiating marcasite, and quartz. Anglesite has not previously been recorded from this district. Gorlan mine, like Welsh Foxdale and Cyffty, was worked on a galena-blende-marcasite lode traversing slate. At all of the British localities for dundasite the mineral was obviously the last formed of its associates.

10. *Wulfenite from Hartsop Hall mine, Patterdale, Westmorland.*

In 1933 among some specimens of fluorite which I collected at this mine is one which shows very minute crystals of wulfenite, a mineral hitherto recorded from only three other British localities. Hartsop Hall, an old lead mine, has for some years been again at work on a very small scale and the specimen to be described was obtained from no. 2 level on a lead lode traversing altered Borrowdale ash. The specimen consists of drusy quartz upon which are small greyish superficially altered cubo-octahedra of galena and small pale yellow cubes of fluorite, also a little calcite, platy aggregates of baryte, and a crystal or two of chalcopyrite. Upon the cubo-octahedra of galena and sometimes on the quartz are numerous very minute but sharp thin tabular crystals of wulfenite with crystals of cerussite. The largest crystal does not exceed $\frac{1}{2}$ mm. along the edge. The colour is either smoky-brown or pale yellowish, and the crystals are simple combinations of (001) and (111), fig. 1. The measured angle (001) (111) $= 65° 48'–65° 56'$, calc. $65° 51'$. An X-ray photograph very kindly taken by Mr. F. A. Bannister definitely proves the mineral to be wulfenite. A more recent careful search failed to produce a single additional specimen.

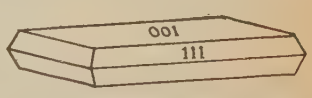

Fig. 1. Wulfenite from Hartsop Hall mine, Patterdale, Westmorland.

I had hoped at first that these minute crystals might prove to be stolzite, a mineral which has been recorded many years ago from Force Crag mine, Braithwaite, Cumberland, but which has never been substantiated as a British species. In R. P. Greg and W. G. Lettsom's 'Mineralogy of Great Britain and Ireland', 1858, pp. 410–411 it is stated that stolzite was 'first noticed in this country by Mr. Greg, in very minute but measurable crystals, on macled crystals of black

carbonate of lead from Force Craig lead-mine, near Keswick. The crystals were of a greyish-white colour, brilliant', with combinations of (001) and (111), the figure given showing them to be of a similar, though somewhat stouter habit than the wulfenite here described. The specimen of stolzite mentioned by Greg would, one should have supposed, be in the Allan–Greg collection in the British Museum, but in spite of a careful search no trace can be found of any specimen either of cerussite or stolzite from Force Crag mine, neither is there a reference to such in the Allan–Greg MS. catalogue. In the absence of evidence that it was chemically examined it seems quite possible that Greg's mineral was wulfenite and not the very much rarer stolzite.

ARTHUR RUSSELL: GOLD NUGGET FROM LEADHILLS, LANARKSHIRE
(*Twice the actual size*)

MONOCHROME REPRINT OF ORGINAL COLOUR REPRODUCTION

An X-ray study on the crystal-structure of gümbelite.

(With Plate II.)

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Introduction.

Dana[1] classifies gümbelite in the kaolin division under pyrophyllite, and expresses the view that it may be an impure pyrophyllite. The present study, however, has shown that the unit cell of gümbelite is very similar to that of muscovite. Also the chemical analysis reveals a closer similarity to muscovite, particularly to a variety called hydromuscovite.

There are available no published X-ray data on gümbelite. Also from the mineralogical and chemical standpoint gümbelite is not an extensively studied mineral. Dana records two chemical analyses, both of which are unsatisfactory. A more up-to-date description and analysis of gümbelite, found at Shunga, Vaonezhye peninsula, Lake Onega, Karelia, Russia, has been reported by Timofeev.[2] This gümbelite occurs in veins in carboniferous slate. Sheets of fine, flexible fibres of about 1 cm. long are packed with the fibre axis perpendicular to the walls. According to Timofeev, fibres of 0·003 to 0·005 mm. in diameter can be separated.

Description of the X-ray photographs.

When a small bundle of gümbelite from Karelia is placed with its axis perpendicular to the X-ray beam, and a rotation photograph taken, a fibre diagram is obtained which differs from a powder photograph in that: (i) on the equator there are half a dozen short, sharp reflections, like those found on single-crystal photographs (these are later called the even orders of $00l$ reflections, with a spacing $d_{001} = 20{\cdot}0$Å.); (ii) not all the Debye lines are complete circles, but some of them vanish somewhat above the first layer-line, others above the second layer-line, (pl. II, figs. 1 and 2); (iii) none of the Debye lines is of uniform blackening: more intense portions (subsequently called bulges) are either at the equator, or at heights corresponding to one or another of the layer-lines of about 5·2Å. identity period along the fibre direction.

Oscillation photographs of thin bundles of gümbelite exhibit spotty Debye arcs, showing that the fibres are not good single crystals, and also that they are not packed completely at random.

The appearance of the X-ray pattern of gümbelite can be explained if the crystallites of the specimen are imagined to lie with the (001) plane parallel to

[1] Dana, Descriptive mineralogy, 6th edition, New York, 1892.

[2] V. M. Timofeev, Trav. Soc. Nat. Leningrad, 1925, vol. 55, part 1, pp. 95–101. A description in English of the occurrence in the shungite deposit is given, with a map, in the XVII International Geological Congress guide-book 'The Northern Excursion, The Karelian ASSR', 1937, p. 55. See also V. M. Timofeev, The petrography of Karelia, 1935 [M.A. 7–197.]

the fibre direction (cf. the shortness of the 00*l* spots). The *a* (5·2Å.) and *b* (9·0Å axes, however, can make any angle with the fibre direction in their plane. certain preferred orientation would account for the bulges on the layer-line A reciprocal lattice model of such a specimen will be obtained by rotating th reciprocal lattice (of a perfect crystal) about the *c** axis, which is the normal the (001) plane, i.e. a system of circles with their centres on, and their plan perpendicular to, the *c** axis. A rotation photograph, corresponding to such model, should exhibit Debye arcs, if the axis of rotation is in the plane of th circles. As the radius of the reciprocal circles depends on the indices *h* and then also the maximum height any Debye arc can attain is determined by th same indices. Thus, the length of the arcs can give additional information indexing.

Indexing.

The identity period along the fibre direction is approximately 5·2Å., as measure from the layer-lines. The spots on layer-lines of gümbelite are too indistinct reliable measurement, thus only $4\sin^2\theta$ values of those reflections the arcs which cross the equator are available. As for a more accurate determination the length of the axes *a* and *b*, experience has shown that though in silicates th lengths of two axes vary from 8·9 to 9·2Å., and from 5·14 to 5·3Å. respectively the axial ratio remains constant within a fraction of one per cent. The square

TABLE I. $4\sin^2\theta = \rho^2$ values for gümbelite from Nordhalben and from Karelia. The indice *hkl* are for a monoclinic unit cell with [110] along the fibre direction. *a* 5·21, *b* 9·02, *c* 20·12 Å *β* 96·0°. A dot (·) in the column of estimated intensities (Int.) indicates a line with a bulge the equator. B = a broad line. $\Delta\rho^2 = \rho^2_{obs.} - \rho^2_{calc.}$ Cu K_α radiation.

Nordhalben $\rho^2_{obs.}$	Karelia $\rho^2_{obs.}$	Int.	Karelia *hkl*	Karelia $\Delta\rho^2\times10^4$.
0·0233	0·0240	8·	002	+3
0·0935	0·0945	8·	004	−2
0·1173	0·1173	7·	110	0
			11$\bar{1}$	−9
0·1274	0·1280	1·	111	+1
0·1552	0·1560	5·	11$\bar{3}$	−1
0·1742	—	(1)	023 ?	
			113 ?	
0·1912	0·1924	5·	11$\bar{4}$	−3
0·2093	0·2126	10·	006	−4
0·2279	0·2312	5·	114	+1
0·2506	—	(1)	11$\bar{5}$?	
			025 ?	
0·2866	0·2882	4·	115	−9
0·2981	0·3017	4·	11$\bar{6}$	+3
0·3540	0·3545	5	116	−45
			200	+47
			20$\bar{2}$	−28
0·3723	0·3791	5·	008	+14
0·4002	0·4057	3B	202	+100
			20$\bar{4}$	−34
0·4665	0·4666	3·	220	−22
			22$\bar{1}$	+15
0·4917	0·4892	3·	221	+49
			22$\bar{3}$	−41
			204	+33
0·5503	0·5565	3B	223	+56
0·5814	0·5922	9·	0 0 10	+5
—	0·7742	1·	22$\bar{8}$	+35
0·8197	0·8250	3	24$\bar{2}$	+33
			310	+22
			227	−9
0·8809	0·8747	3	24$\bar{4}$	+12
			312	−6
			31$\bar{4}$	+48
0·9366	0·9342	3	228	+99
1·0469	1·0457	6·	33$\bar{1}$	−6
			33$\bar{2}$	−40
—	1·0703	1	331	−48
			33$\bar{3}$	+54
1·1419	1·1604	5·	0 0 14	+8

The reflections at ρ^2 0·1742 and 0·2506 are those which may necessitate the adoption of triclinic unit cell for gümbelite from Nordhalben, see the section *Conclusions*.

The axial ratio is about 2·9 for chain structures (amphiboles and pyroxenes), and 3·0 for sheet structures. Because the axial lengths of gümbelite are so nearly equal to the corresponding axes of muscovite, and for other considerations which follow, the ratio $(b/a)^2 = 3{\cdot}00$ is accepted for gümbelite. This means that the spacing d_{020} is very nearly equal to d_{110}. The lengths of the a and b axes will be calculated in this way, in agreement with the position of reflections of the type $\{hhl\}$. For the third axis, d_{001}(20·00Å.) is accurately measurable (cf. table I).

Chemical composition.

Table II shows the chemical composition of two gümbelites, found in the same localities as the specimens now investigated, though they are not from the same samples. Timofeev (loc. cit.) states that in pure samples gümbelite is quite white, but it is often tinted yellow or greenish by iron oxides. He concludes that iron and lime are supplied from outside, as well as 0·24 % of the water, which do not take part in composition. Eliminating the uncombined water, FeO, and CaO,

TABLE II. Chemical composition of gümbelite: I from Shunga, Karelia (Timofeev, loc. cit.), and II from Nordhalben, Bavaria (Kobell, quoted from Dana).

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	CaO.	Na_2O.	K_2O.	H_2O+.	H_2O-.	insol.	Total.
I.	49·54	0·87	29·51	—	0·70	4·14	0·25	0·35	8·21	6·56	0·24	—	100·37
II.	50·52	—	31·04	3·00	—	1·88	—	—	3·18	7·00	—	1·46	98·08

and recasting the analysis in atomic proportions on the basis of O_{48} (which is the number of oxygen atoms in muscovite-like structures), table III is obtained. From table III the similarity of gümbelite from Karelia to muscovite, particularly to hydromuscovite variety 'A', of Brammall, Leech, and Bannister,[1] is obvious when the metal atoms are grouped according to structurally equivalent positions.

TABLE III. Comparison of the chemical composition of gümbelite from Karelia, and that of hydromuscovite 'variety A' (Brammall et al., loc. cit.) in atomic proportions based on O_{48}.

	Gümbelite.		Hydromuscovite.		Muscovite (ideal).	
Si	12·77	16·00	12·00	16·00	12	16
Ti	0·17		—		—	
Al	3·06		4·00		4	
Al	5·91	7·50	7·06	7·52	8	8
Mg	1·59		0·20		—	
Fe	—		0·22		—	
Ca	—		0·04		—	
K	2·70	2·88	2·66	2·88	4	4
Na	0·18		0·22		—	
(OH)+	11·28	48·00	10·88	48·00	8	48
O	36·72		37·12		40	

The density of gümbelite.

A 'molecule' of gümbelite comprising 48(O,OH,F) and a number of metal atoms corresponding to the composition (table II), weighs $1539 \times 1{\cdot}650 \times 10^{-24}$g. The volume of the unit cell of gümbelite of Karelia is 940×10^{-24}cm.^{3} (see below, p. 14), which gives a density of 2·702 g./cm.^{3}, which does not agree with the

[1] A. Brammall, J. G. C. Leech, and F. A. Bannister, Min. Mag., 1937, vol. 24, pp. 507–520.

density 2·946 g./cm.^{3} as reported by Timofeev, but which compares favourably with the density of the specimen used. Dr. Max H. Hey kindly determined (by flotation) the density of Karelian gümbelite used in the present study, and found 2·770±0·005. (The writer obtained a density somewhat less than 2·80 g./cm.^{3}) The difference of 2·5 % between the densities obtained by the macroscopic (Dr. Hey) and X-ray methods might be caused because (i) the chemical analysis and the density reported by Timofeev is not strictly applicable to the sample used in this work, or (ii) although the spacings d_{110} and d_{001} are quite accurate, the assumption that the ratio $(b/a)^2 = 3{\cdot}00$ is somewhat arbitrary. For example, a ratio of 2·9 (that of the chain structures) would decrease the volume of the unit cell by 1·2 %, and would reduce the observed discrepancy to 1·3 %.

Optical properties.

According to Timofeev, gümbelite from Karelia has straight extinction (though occasionally oblique extinction has been observed, which is explained by the free orientation, and bending of the fibres). The refractive index n_γ coincides with the length of the fibre. $2E = 68° 52'$, $2V = 42° 21'$, with a maximum deviation of 2° on either side. Dispersion is not observed; a direct determination of double refraction by means of compensator did not give definite results.

It can be seen that the refractive indices of gümbelite do not differ much from those of hydromuscovite, and those of muscovite (particularly when [110] is taken parallel to n_γ).

TABLE IV. Comparison of optical data.

	n_α	n_β	n_γ
Hydromuscovite 'A', Wales (Brammall et al.) ...	—	1·575	1·580
Gümbelite, Karelia (Timofeev)	1·568	1·571	1·596
Muscovite (textbooks)	1·561	1·594	1·600

The analogy between gümbelite and muscovite.

Assuming gümbelite to have a monoclinic unit cell with its [110] direction parallel to the fibre, the unit cell a 5·21, b 9·02, c 20·12Å., β 96·0°, will be in close agreement with observations (cf. table I). In comparison, the unit cell of muscovite has a 5·18, b 9·02, c 20·04Å., and β 95·5°. This similarity between the unit cells of gümbelite and muscovite is accompanied by a similarity in chemical composition and in optical properties. With this muscovite-like unit cell, orientated with the [110] direction preferably along the fibre direction, all the bulges are accounted for. Deviations in the plane of ab up to 30° must occur to account for the length of the arcs. It seems, however, that the deviations are smaller than 60°, as some of the bulges on the first layer-line of type $\{11l\}$ are not extended to the equator (cf. fig. 1).

A photograph of gümbelite from Nordhalben, Bamberg, Bavaria (pl. II, fig. 2) displays less marked preferred orientation. The c axis of this gümbelite is 1·0 % larger than for Karelian gümbelite, but the a and b axes are of the same length, within the error of measurement. Except for two weak lines reaching the equator, the patterns of the two gümbelites are similar. The $4\sin^2\theta$ values for both gümbelites are included in table I. There is a slight preference, in gümbelite from Nordhalben, for the b[010] direction to lie parallel to the needle axis, in a sector

f semi-angle 30° in the plane of *ab*. [Gümbelite of Nordhalben is flaky rather han fibrous, and easily separated into short, irregular needles.]

The X-ray pattern of gümbelite was imitated by registering on the same film number of rotation photographs of muscovite. For each exposure a different ne in the cleavage plane between the directions [110] and [010] was set parallel o the axis of rotation. In fig. 3 the axis of rotation lies in a sector from $-6°$ o $+22°$ from the [110] direction towards [010], in steps of approximately 3°. he gaps in the arcs appear because the experiment was not continued until 010] became vertical.

Conclusions.

It has been shown that the X-ray fibre diagram of gümbelite from Karelia, its nit cell, chemical composition, and optical properties are comparable with those f muscovite, particularly with those of hydromuscovite. Gümbelite from Karelia monoclinic, a 5·21, b 9·02, c 20·12Å., β 96·0°. The [110] direction lies pre-ominantly parallel to the fibre direction, though deviations over 30° (but less ıan 60°) occur in the (001) plane. The density obtained by X-ray methods is 70 g./cm.^{3}, and 2·770 g./cm.^{3} by macroscopic methods.

Small flakes of gümbelite from Nordhalben exhibit a similar X-ray pattern, ıough with a less notable preferred orientation in the (001) plane. The unit ell is also monoclinic, and of the same dimensions as gümbelite from Karelia, xcept that the c axis is 1·0 % larger (d_{001} = 20·20 Å.). In the case of gümbelite om Nordhalben, however, a triclinic unit cell may seem necessary, to bring ıe indices of two weak lines into a better agreement. The triclinic unit cell ould have d_{100} = 5·18, d_{010} = 8·97, d_{001} = 20·20 Å. The angle between the 10) and (001) planes is 84·85°, the angle between the (100) and (001) planes ·26°, and the angle between the [100] and [010] directions 90°.

A complete determination of the crystal-structure of gümbelite is not claimed, ıt it seems that gümbelite should be classified amongst muscovites, with some bstitution (in a ratio 1 to 4 approximately) of magnesium for aluminium.

Acknowledgements.

The experimental part of this work was carried out in the Cavendish Laboratory, Cambridge, while holding a Scholarship from the British Council. The ·iter wishes to express his gratitude to Professor Sir Lawrence Bragg, to Dr. J. Bradley and Dr. H. Lipson. Professor C. E. Tilley, Mr. F. A. Bannister, d Dr. G. Nagelschmidt greatly helped by providing the specimens, and with ;cussions.

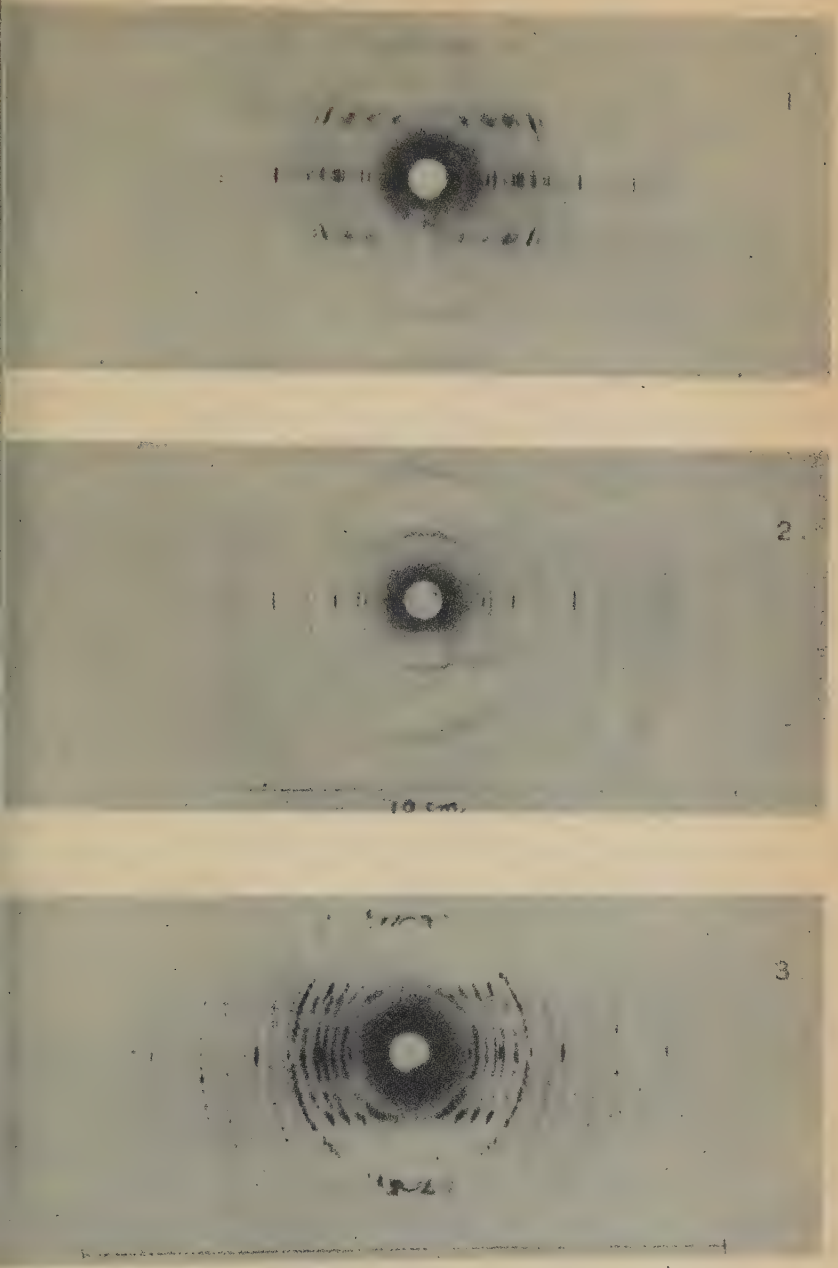
EXPLANATION OF PLATE II.

FIG. 1. Rotation photograph of gümbelite from Shunga, Karelia, Russia, about the fibre direction.

FIG. 2. Rotation photograph of gümbelite from Nordhalben, Bavaria, about the elongation of the flake. (British Museum specimen, reg. no. 44126.)

FIG. 3. Imitated pattern of gümbelite—muscovite rotated consecutively about several axes between [110] and [010] in the cleavage plane.

Figs. 1, 2, and 3 were taken in a cylindrical camera of 60·0 mm. diameter, using filtered K_α radiation. A length of 100 mm. was marked on the original photographs.



E. Aruja: X-ray Photographs of Gümbelite.

MINERALOGICAL ABSTRACTS

(Vol. 9, No. 1, March, 1944.)

Notices of Books

HAND (S. James). *Eruptive rocks: their genesis, composition, classification, and their relation to ore-deposits with a chapter on meteorites.* Revised 2nd edit. London (Thomas Murby & Co.) & New York (John Wiley & Sons, Inc.), 1943, xvi+444 pp., 3 pls., 47 text-figs. Price 25*s*.

The first edition (1927) of this book has been very extensively revised. The uthor has made full use of the excellent library at Columbia University, New ork, where he has been Professor of Geology since 1937, and he has incorporated judicious selection from the important contributions to petrology published rior to 1939. The typescript was then sent to London but the war and the eath of the publisher have prevented its production until this year. However, me references to work published since 1939 have been inserted in the proofs and oth the author and the publishers are to be congratulated on bringing out an p-to-date treatise on petrology, well printed, on good paper, and at a reasonable rice during the war. Chapter IX, on 'Eruptive rock complexes', is new, and ther chapters have been rearranged. Much more space has been devoted to apters on the 'Occurrence and genesis' of each of the main classes in the uthor's classification. Examples and a discussion of the mineralogy of each ass are given in separate chapters. Sections on the chemistry of the classes are mitted. The chapter on the occurrence and genesis of the undersaturated rocks elspathoidal division) has been almost entirely rewritten: the author's views n the origin of these rocks, a subject on which he has been writing since 1922, main unaltered. One of the quite new parts of this chapter discusses the resence of analcime in eruptive rocks, both as 'insets' and as interstitial material. he chapter on ore-deposits has been omitted, and to the chapter on meteorites added a note on recent discoveries of tektites and the Libyan glass, and a brief iscussion on the pre-geologic history of the earth. As regards the classification, hich was described at length in the notice of the first edition [M.A. **3**-317], here is little change. An improvement is made by the introduction of symbols r the subdivisions, which enables some of the argument about rock names to be voided. Ample criticisms of the details of the classification have been and will e offered, but the author succeeds in his object, which has been to frame a hysico-chemical classification and 'to show how rocks can be grouped in such way that each group will convey the greatest possible amount of information bout the physical and chemical history of the magma-system'. The system of assification and the description of the rocks in each class do not form the ajor part of the book, nor are the chapters dealing with them the most impor- nt. The book is neither a text-book nor a system of petrography, but a treatise n the petrology of the eruptive rocks which can be read with pleasure and rofit, whether the reader agrees with the author's views on classification and omenclature or not.

W. C. S.

WINCHELL (Alexander N.). *Elements of mineralogy emphasizing the variations minerals.* New York (Prentice-Hall, Inc.), 1942, xiii+535 pp., 1 col. p 468 text-figs. Price $5.00.

The theme of this new elementary text-book is that minerals are not fix and simple in composition or in properties, in illustration of which fact the auth reproduces many of the useful variation diagrams that characterize his 'Elemen of Optical Mineralogy' [M.A. 5–337], supplementing these wherever possible similar graphs on additional mineral groups. The work is in six main chapters crystallography and on physical, chemical, descriptive, economic, and dete minative mineralogy, which respectively occupy 119, 55, 41, 175, 31, and pages, the last comprising long determinative tables based on streak and speci gravity, hardness and streak, cleavage and lustre, and refractive index. Intr ductory accounts are given on the X-ray study of crystals, on the atomic structu of silicates, and on the use of Hermann-Mauguin symbols in crystallograph but it is remarkable to find no reference to any type of goniometer, and mention of bromoform in two pages on heavy liquids. A statement that 'epsomit has been obtained largely from England' is untrue; while the mineral localitie given in the descriptive and economic sections do not always include those of th greatest economic importance. Notwithstanding these omissions, the compr hensive nature of the text-book will lead to its being widely used. It is printed o heavy paper and strongly bound, in a format which shows no signs of wartim restrictions. C. F. D.

NEWHOUSE (W. H.) (editor). *Ore deposits as related to structural features.* Princ ton, New Jersey (Princeton Univ. Press) & London (Oxford Univ. Press 1942, vii+280 pp., numerous figs. Price 44*s.*

Sixty-five authors contribute 79 articles to this symposium prepared unde the direction of the Committee on Processes of Ore Deposition, Division of Geolog and Geography, National Research Council, Washington. All their communica tions deal with some aspect of the relationship between ore deposition an structural geology. Most of the contributions are descriptive of mineral deposit in North America (56 papers), but some studies on South American (4), Australia (5), Japanese (3), European (2), and S.W. African (1) mines are also included Among the eight more general articles may be mentioned a lengthy analysis the other contributions, by the editor; a dissertation on pyrometasomatic deposit by Adolph Knopf; a useful review of chromite deposits, by Edward Sampson and a brief paper on structural petrology applied to ore deposits, by H. W Fairbairn. The volume, size 12×9 inches, is excellently produced and we illustrated by many text-figures. C. F. D.

DAKE (H. C.) & DE MENT (Jack). *Fluorescent light and its applications.* Brooklyn N.Y. (Chemical Publishing Co., Inc.), 1941, xi+256 pp., 24 (unnumbered figs. Price $3.

The principal chapters of this new work deal with the theory and differen types of luminescence, laboratory sources of ultra-violet radiations, the lumines cent (particularly fluorescent) minerals, the luminescence of gems, notabl American collections of fluorescent minerals, and commercial applications

ultra-violet light. The book is written in a simple and popular style, but nevertheless the sections on apparatus and on the luminescence of minerals are more comprehensive and up-to-date than any comparable publication available in the English language. Despite 'careful proof-reading' there are many misprints. The authors are described on the title page as editor and associate editor of 'The Minerologist [*sic*] Magazine' (of Portland, Oregon). C. F. D.

Whitaker (Arthur Preston). *The Huancavelica mercury mine. A contribution to the history of the Bourbon renaissance in the Spanish empire.* Cambridge, Mass. (Harvard University Press), 1941, xiii+150 pp., 1 plate. Price 12*s*.

This well-documented memoir is a historical study of the Spanish administration of the mercury mines at Huancavelica, Peru, discovered by Spanish colonists in 1563, but previously worked by the Incas. Until the early nineteenth century the Peruvian mines were second only in importance to those of Almaden in Spain. C. F. D.

Seward (*Sir* Albert Charles) [1863–1941]. *Geology for everyman.* With a preface by Sir Henry Lyons. Cambridge (University Press), 1943, xi+312 pp., 9 pls., 10 text-figs. Price 10*s*. 6*d*.

The author of this charmingly written little book was for thirty years professor of botany at Cambridge, but he had been trained as a geologist, gaining the Harkness Scholarship and the Sedgwick Prize. His special interest was palaeobotany, in which subject his first lectures (which I had the advantage of attending) were delivered in the geology department. The opening chapters give a sketch of the present-day physiographical conditions on the earth's surface, with some account of the different types of rocks. Following chapters take the reader back through time, describing the changes in the main geological periods, with such chapter headings as 'Salt lakes and deserts' (for the Triassic and Permian) and 'Northern lakes and a southern sea' (for the Old Red Sandstone and Devonian). Prominence is given to the flora, climate, and palaeogeography of each period. The writing of the book was completed only three days before his sudden death in 1941 in his 78th year. It was passed through the press by the help of friends, of whom he had many. A posthumous popular book by his contemporary at Cambridge, Alfred Harker, was recently issued under similar circumstances [M.A. 8–98]. L. J. S.

Krusch (Paul). *Die metallischen Rohstoffe, ihre Lagerungsverhältnisse und ihre wirtschaftliche Bedeutung.* Part I, *Vanadium, Uran, Radium.* Stuttgart (Ferdinand Enke Verlag), 1937, viii+148 pp., 17 figs., price RM. 10; Part 2, *Molybdän, Monazit, Mesothorium.* 1938, iv+87 pp., 8 figs., price RM. 6.

Two of the fifteen separate parts to appear in this new compendium are listed above. They summarize, country by country, the world distribution of the commercial ores of vanadium, uranium and radium, molybdenum, and the rare-earths, with geological data on the occurrences and with details of production. There are frequent references to the literature, the selection of which might, in some cases, have been improved; for example, the pages on uranium and radium

in the U.S.S.R. omit any reference to the 'Transactions for the Study of Radium and Radioactive Ores' of the Russian Academy of Sciences. C. F. D.

New Minerals

Royo y Gómez (José). *Novedades mineralógicas. II–III.* Ciencia, Mexico, 1941 vol. 2, pp. 154–155; 1942, vol. 3, pp. 337–349.

Abstracts of recent papers on new minerals and on proven identities. [M.A 8–145.] L. J. S.

Magnusson (Nils H.). *Långbans malmtrakt, geologisk beskrivning.—The iron and manganese ores of the Långban district.* Avh. Sveriges Geol. Undersök., Ser Ca, 1930, no. 23, 111 pp., 5 pls. (maps), 47 text-figs. English summary pp. 104–111. Price 8 *kr.*

An account of the geology, mines, rocks, ores, and minerals of Långban Sweden, includes a brief description of an amphibole variety named *tibergite* This is brownish-purple with red and bluish-green pleochroism and $\gamma : c = 32°$ Analysis by A. Bygdén, SiO_2 41·85, TiO_2 0·16, Al_2O_3 12·63, Fe_2O_3 8·08, FeO 0·99 MnO 2·22, MgO 16·24, CaO 10·95, Na_2O 4·02, K_2O 0·24, H_2O 2·42 = 99·80, is interpreted as a mixture of richterite and $R_2(Al,Fe)_4Si_2O_{12}$ molecules. The usual Mn-amphibole is richterite with $\gamma : c = 15–18°$. Many chemical analyses of the several minerals, rocks, and ores are collected from the literature L. J. S.

Fleischer (Michael) & Richmond (Wallace E.). *The manganese oxide minerals: a preliminary report.* Econ. Geol., 1943, vol. 38, pp. 269–286.

The characters of a number of minerals are outlined, giving X-ray powder photographs and spacing data, and in some cases suggesting new chemical formulae. A long list of localities of specimens examined is appended. The name psilomelane, as commonly applied to hard massive material includes several distinct minerals; for these the term 'psilomelane type' should be used. *Ramsdellite* is briefly described as a new orthorhombic form of MnO_2 occurring as thick tabular crystals and as massive platy material with two cleavages at right angles. Localities in New Mexico, Nova Scotia, and Turkey are listed. When heated at 300° it inverts to pyrolusite (= polianite, tetragonal MnO_2). L. J. S.

Villiers (J. E. de). *A preliminary description of the new mineral partridgeite.* Amer. Min., 1943, vol. 28, pp. 336–338.

Partridgeite from Postmasburg, South Africa, differs from the intimately associated braunite and sitaparite in colour and etching reactions. It is dark steel-grey with a yellowish tinge, distinct octahedral cleavage, and weak anisotropism. Analysis by C. F. J. van der Walt of the ferriferous variety, MnO 53·02, MnO 37·90, Fe_2O_3 6·71, SiO_2 0·36, Al_2O_3 1·49 = 99·48, sp. gr. 4·96, corresponds to 87 % partridgeite. The formula $(Mn,Fe)_2O_3$ is the same as for sitaparite [and bixbyite, M.A. 8–365]. Other analyses correspond to 75 and 29 % with admixed braunite and pyrolusite, and show only 0·56 and 0·5 % Fe_2O_3. The braunite contains B_2O_3 1·1 %. L. J. S.

ILLIERS (J. E. de) & FLEISCHER (Michael). *A discussion: bixbyite—sitaparite—partridgeite.* Amer. Min., 1943, vol. 28, pp. 468–469.

B. Mason [M.A. **8**–365] has suggested the identity of bixbyite and sitaparite, taining the former name. This is supported by Fleischer. For minerals $Mn,Fe)_2O_3$ de Villiers applies the name partridgeite to those with less than 10 %, taparite 10–30 %, and bixbyite > 30 % Fe_2O_3. Analysis by C. F. J. van der 'alt of sitaparite from Postmasburg gave MnO_2 44·2, MnO 33·0, Fe_2O_3 21·9, O_2 0·1, CaO 0·2, BaO 0·1 = 99·5, sp. gr. 5·00; other specimens contained 14·4,)·3, 25·6 % Fe_2O_3. L. J. S.

ILLIERS (J. E. de). *Gamagarite, a new vanadium mineral from the Postmasburg manganese deposits.* Amer. Min., 1943, vol. 28, pp. 329–335, 4 figs.

Manganese ore from Gamagara ridge [M.A. **4**–232] consists of sitaparite with)hesite [Min. Mag. **22**–482], diaspore [M.A. **4**–148], and a new vanadium mineral :magarite. The last is present as needles and flat prisms 1 cm. long. It is very ırk brown with adamantine lustre and reddish-brown streak. Sp. gr. 4·62, . 4½–5. The monoclinic crystals are elongated along the *b*-axis, with cleavages 01), (100), and poor ($\bar{1}01$); $a : c = 1 : 1{\cdot}15$, β 62° 40′. Optic axial plane (010), : $c = -33$–$43°$, 2V 46–62°, positive, $r < v$, α 2·016, β 2·040, γ 2·130; pleochroism, red-brown, β very deep red-brown, γ light salmon-buff. Analysis by C. F. J. ın der Walt of material enclosing about 2 % of haematite and sitaparite gave $_2O_4$ 29·1, BaO 52·4, FeO 7·6, MnO 5·5, H_2O+ 1·06, O 3·55 = 99·21, agreeing ith $Ba_4(Fe,Mn)_2V_4O_{15}(OH)_2$. The sitaparite has the form of small cubes with mellar twinning and very weak anisotropism, and encloses plates of diaspore ırallel to the cube faces. L. J. S.

ICHENER (C. E.) & PEACOCK (M. A.). *Parkerite ($Ni_3Bi_2S_2$) from Sudbury, Ontario: redefinition of the species.* Amer. Min., 1943, vol. 28, pp. 343–355, 11 figs.

This mineral occurs as small (1 mm.) grains in veinlets in the ore-body with lena, native bismuth, pyrrhotine, &c. It is orthorhombic, tabular on the rfect cleavage (001) and shows lamellar twinning with parting on two planes (111). Bright bronze colour, metallic lustre, shining black streak, sp. gr. 43–8·44, H. 3. Polished sections are strongly anisotropic and noticeably eochroic. Analysis by W. Wagner on 2·75 mg. (30 mg. for S) gave Ni 26·8, 63·6, S 9·2, Pb trace = 99·6. The unit cell, *a* 4·02, *b* 5·52, *c* 5·72 Å. ($a : b : c$ = 728 : 1 : 1·036), contains $Ni_3Bi_2S_2$; space-group probably $C_{2v}^1 = Pmm2$. Similar aterial was prepared by fusing the elements in the proper proportions. The ineral is identified with parkerite from South Africa [M.A. **6**–440] on the basis X-ray powder data, it being probable that Bi was overlooked in the original alysis. L. J. S.

ONDEL (Clifford). *Mineralogy of the oxides and carbonates of bismuth.* Amer. Min., 1943, vol. 28, pp. 521–535, 4 figs.

Most of the many specimens labelled 'bismite' were found to be bismutite, for ich a list of 46 localities is given. The name bismite is restricted to the mono-

clinic low-temperature form α-Bi_2O_3 of Sillén [M.A. **7**–234; **8**–9, 216]; this is found as a fine-grained greyish-green alteration product on native bismuth from Colavi, Bolivia; sp. gr. 8·64, H. 4½, $n > 2{\cdot}42$. The body-centred cubic form of Bi_2O_3 prepared by Sillén is named *sillenite*; this was found as greenish waxy masses from Durango, Mexico. A bismuth hydroxide containing 9·2 % H_2O, possibly $Bi_2O_3.3H_2O$, occurs as an earthy alteration product of bismite from Colavi, but the X-ray data are not sufficient to establish a definite species. Bismutite is Bi_2CO_5, the water often present is gradually lost up to 290° and is regarded as non-essential; dehydration curves are given, and the final product of heating is α-Bi_2O_3. Bismutite is found as earthy masses, distinct crystals not being known; sp. gr. 6·61–7·33, $n < 2{\cdot}12$ to $> 2{\cdot}30$. Bismutosphaerite and basobismutite both give the same X-ray pattern as bismutite, and hydrobismutite and normannite are also probably identical with this. A new carbonate, *beyerite*, occurs as minute platy tetragonal (D_{4h}) crystals at Schneeberg, Saxony and as earthy masses at Pala, California; a 3·78, c 21·77 Å., sp. gr. 6·56, ω 2·13, ϵ 1·99; spectrographic analysis showed the presence of much Bi, some Ca, and traces of several other elements. Another carbonate of unknown chemical formula, but regarded as a distinct species, is waltherite (J. F. Vogl, 1857) from Joachimsthal, Bohemia; minute monoclinic crystals of prismatic habit have *mm* 116° 34′, c 5·42 Å., sp. gr. 5·32, $\gamma(=b)$ 1·91, $\alpha : c = 16°$, 2V 75°, negative (also 2V 90°, positive). X-ray powder patterns and spacing data are given for bismite, bismutite, sillenite, beyerite, and waltherite. L. J. S.

Merkulova (G. V.). [*A new mineral—shilkinite.* Mém. Soc. Russe Min., 1939, vol. 68, pp. 559–561 (Russian with English summary)]; abstracts in Chem. Abstr. (Amer. Chem. Soc.), 1942, vol. 36, col. 5443; Amer. Min., 1943, vol. 28, pp. 62–63.

Fibrous and fan-shaped aggregates replace orthoclase in pegmatite near the Shilka river in eastern Transbaikalia. Sp. gr. 2·795–2·804, H. 3–4, α 1·55, β 1·570, γ 1·585, 2V 67°, negative. Analyses (also TiO_2 traces) I of greyish-green, II of greenish-white varieties, agreeing with $K_2O.4Al_2O_3.8SiO_2.4H_2O$. Insoluble in acid. [Min. Mag. **26**–341.]

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	MgO.	CaO.	Na_2O.	K_2O.	H_2O+.	H_2O-.	Total
I.	45·17	37·03	1·30	trace	0·04	0·60	0·47	0·47	8·09	6·31	0·65	100·1
II.	46·59	34·50	2·20	0·15	0·05	0·88	0·53	0·44	8·11	5·80	0·71	99·9

L. J. S.

Kašpar (Jan V.). [*Hanušite, a new mineral.* Chem. Listy, Praha, 1942, vol. 36, pp. 78–81]; abstracts in Chem. Abstr. (Amer. Chem. Soc.), 1943, vol. 37, col. 4335; Amer. Min., 1943, vol. 28, p. 544.

Yellowish radiating aggregates, similar in appearance to pectolite, occur as pseudomorphs after apophyllite near Liebstadtl (Libštát), NE. Bohemia. Sp. gr. 2·166, H. 1–1½, 2V large, birefringence greater than that of sepiolite, from which the X-ray powder pattern also differs. Decomposed by HCl with separation of silica; the dehydration curve indicates that water given off below 200° is adsorbed, most of the remainder is given off at 700°. Analysis gave SiO_2 57·37, FeO 3·57, MnO 0·54, MgO 18·55, CaO 4·84, H_2O (+200°) 6·49, H_2O (−200°) 8·68

corresponding to $H_2Mg_2Si_3O_9.H_2O$. The mineral is regarded as the magnesium end-member of the pectolite-walkerite series. L. J. S.

GUIMARÃES (Caio Pandiá). *Nota prévia sôbre um novo mineral da família dos tantalates.* Rev. Quím. Ind., Rio de Janeiro, January 1943, vol. 12, no. 129, p. 14.

This occurs in a pegmatite worked for tantalite between Picui and Currais Novas, near the boundary of the states of Rio Grande do Norte and Paraiba. Honey-yellow crystals are tetragonal with distinct basal cleavage and conchoidal fracture; sp. gr. 7·10–7·30. Under the microscope it is colourless and transparent, uniaxial and negative, with $n > 2$ and birefringence about that of quartz. Approximate analysis, Ta_2O_5 92 including possibly Nb_2O_5 1–2, Al_2O_3 3, MgO 2–3, CaO 3 % with traces of Ti and Fe, indicates a metatantalate $Al_2(Ta_2O_6)_3$. $(Ca,Mg)Ta_2O_6$, corresponding to tapiolite $(Fe(Ta,Nb)_2O_6)$. L. J. S.

History

SCHROETER (Joachim). *Die Stellung des Paracelsus in der Mineralogie des 16. Jahrhunderts.* Schweiz. Min. Petr. Mitt., 1941, vol. 21, pp. 313–331.

Theophrastus [Bombast] von Hohenheim (1493–1541), Swiss physician and alchemist, better known as Paracelsus, had a considerable knowledge of mineralogy, as is shown especially in his book 'De Elemento Aquae'. He divided metallic ores into marcasites (sulphide and other ores of metallic lustre), cachimien (including orpiment, realgar, stibnite), and true (native) metals; in each class he recognized subdivisions, and observed the characteristic crystal habit of several minerals. Stones included marble, chalcedony, alabaster, and others, while many gems were described. As in his other work, so in his mineralogy, Paracelsus respected Aristotelian authority less than his contemporaries.
M. H. H.

HILLER (Joh.-E.). *Paracelsus und de Boodt als Vorläufer neuzeitlicher Mineralogie.* Naturwiss., 1942, vol. 30, pp. 563–565.

The works of Paracelsus (1493–1541) and of de Boodt (1550–1632) show a transition from the Middle Ages to modern science. L. J. S.

SRBIK (Robert R. v.). *Zur Geschichte der Mineralogie und Alchemie in Deutschland am Beginn der Neuzeit.* Neues Jahrb. Min. Monatshefte, Abt. A, 1943, pp. 33–43.

A commentary on Gregor Reisch (*d.* 1525), 'Margarita philosophica' (Freiburg i. Br., 1503). L. J. S.

STEBBING (W. P. D.). *Some early references to geology from the sixteenth century onwards.* Proc. Geol. Assoc. London, 1943, vol. 54, pp. 49–63.

Amongst other items, reference is made to T. Nicols, 'A lapidary: or, the history of pretious stones' (1652). L. J. S.

Smith (Stanley). *Seventeenth century observations on rocks, minerals, fossils, &c., of Gloucestershire and Somerset.* Proc. Bristol Nat. Soc. 1943, ser. 4, vol. 9, pp. 406–426, 1 pl., 1 text-fig.

Quotations relating to Bristol 'diamonds' and the dowsing for lead ore in the Mendip Hills are given from 'Britannia Baconia' (1661) by Joshua Childrey (1623–1670). L. J. S.

Bromehead (C. N.). *Ancient mining processes as illustrated by a Japanese scroll.* Antiquity, Gloucester, 1942, vol. 16, pp. 193–207, 2 pls.

Description of a scroll (22 feet long) dated about A.D. 1650 showing pictures of a gold mine on Sado island. The mining and smelting methods suggest that they were derived from those in use in Europe in classical times. [M.A. **8**–147.] L. J. S.

Fischer (Walther). *Zum 125. Todestage von Abraham Gottlob Werner.* Zentralblatt Min., Abt. A, 1942, pp. 113–133, 4 portraits.

A further appreciation of the work of A. G. Werner [1749–1817] on the 125th anniversary of his death on June 30, 1817. [M.A. **4**–483, **5**–243, **7**–17, **8**–148.] L. J. S.

Winston (W. B.). *History of the names cobalt and nickel.* California Journ. Mines & Geol., 1941, vol. 37, pp. 472–474.

In German folklore Kobold and Nickel were spirits or demons, and the names were applied by miners to worthless ores resembling those of silver and copper respectively. L. J. S.

Mateos (Josefina Perez). *Minerales patógenos y terapéuticos.* Anal. Cienc. Nat. Madrid, 1941, pp. 60–81.

An enumeration of the many minerals and their products that have been used in medicine in ancient and modern times. L. J. S.

Hildebrand (Bengt). *Kungl. Svenska Vetenskaps Akademien: förhistoria, grundläggning och första organisation.* Stockholm, 1939, 2 vols., 885 pp., 4 pls., 123 text-figs.

This handsomely produced work, published on the occasion of the bicentenary of the Royal Swedish Academy, relates the history of science in Sweden in the late seventeenth and eighteenth centuries. The many naturalists of whom portraits are given include Daniel Tilas (1712–1772), who in 1740 introduced the term 'feldtspat' into mineralogical literature. C. F. D.

Vázques de Espinosa (Antonio), translated by Clark (Charles Upson). *Compendium and description of the West Indies.* Smithsonian Miscellaneous Collections, 1942, vol. 102, xii+862 pp.

This volume is a descriptive itinerary of Spanish America, translated from a hitherto unknown Vatican manuscript written in 1628–9 by Fray Antonio

ázquez de Espinosa, a Carmelite missionary. It is an important historical ocument on the Indies, especially interesting to mineralogists and geologists ecause of the full survey of early mining in South America and the frequent eferences to volcanic eruptions and earthquakes. Among the many paragraphs n minerals and mining special note may be made of the descriptions of the ıercury mines of Huancavelica in Peru; the silver mines of Oruro and Potosí, ow in Bolivia; and the emerald mines near Muzo in what is now Colombia.

C. F. D.

ARSEN (Esper S.). *Geochemistry.* Geology 1888–1938, Fiftieth Anniversary Volume, Geol. Soc. Amer., 1941, pp. 391–413. [M.A. 8–147.]

A review of progress during the past half century, emphasizing the application f physical chemistry to geological problems. L. J. S.

/RIGHT (F. E.). *Methods and instruments used in mineralogy.* (Presidential address.) Amer. Min., 1942, vol. 27, pp. 145–154.

Historical review dealing with goniometers, instrument design, projections, etrographic microscopes, and crystal-structure. L. J. S.

OSS (Clarence S.). *Presentation of the Roebling Medal of the Mineralogical Society of America to Esper S. Larsen, Jr.* Amer. Min., 1942, vol. 27, pp. 155–156.

ARSEN (Esper S.). *Acceptance of the Roebling Medal.* Ibid., pp. 157–161, with portrait.

The fourth award of this gold medal. [M.A. 7–321, 8–149.] L. J. S.

Bibliographies

ibliography of military geology and geography. Geol. Soc. Amer., 1941, 18 pp. Gratis.

A bibliography of current interest containing close on 300 items, principally om British, American, and German literature. C. F. D.

ibliography of publications related to X-ray and electron diffraction 1940. Mimeographed and distributed for the ASXRED by Hercules Powder Company [Wilmington, Delaware; U.S.A., 1943], 18 pp. M. A. P.

EIL (G. E.). *Bibliography on orthosilicates of the alkaline earths with special reference to their use in the refractory field.* Ceramic Abstracts (Amer. Ceramic Soc.), 1940, vol. 19, pp. 273–293.

250 papers and patents relating to the properties and synthesis of forsterite, onticellite, merwinite, and the orthosilicates of calcium, barium, and strontium e listed, with abstracts principally quoted from Chemical Abstracts. Larnite is ot mentioned. C. F. D.

Pettijohn (F. J.). *Mineralogy of sedimentary rocks 1937–1939.* Report of the Committee on Sedimentation, 1939–40, Div. Geol. Geog., Nat. Res. Council Washington, D.C., 1940, pp. 22–69. (Mimeographed.)

A bibliography, with abstracts, listing 160 works published during 1937–39 on the mineralogy and petrography of the sedimentary rocks. C. F. D.

Nickles (John M.), Siegrist (Marie), & Tatge (Eleanor). *Bibliography and index of geology exclusive of North America. Volume* **8**–*1940.* Geol. Soc. Amer., 1941, xix+386 pp. [M.A. **8**–150.]

Annotated bibliography of economic geology for 1940. Econ. Geol. Publishing Co., Urbana, Illinois, 1941, vol. 13, no. 2, viii+337 pp.

Part 2, containing titles and abstracts nos. 1–1006, completes vol. 13 [M.A. **8**–150] and includes a separate index of authors and subjects. L. J. S.

Mineralogisch-geologische Wissenschaften.—Sciences minéralogiques et géologiques. Bibliographie der Schweizerischen naturwissenschaftlichen und geographischen Literatur, Bern (Schweiz. Landesbibliothek), 1942, vol. 16, pp. 55–88.

Titles of papers relating to Swiss mineralogy and geology grouped under various subject headings. Those on mineralogy, crystallography, and petrology (pp. 57–60) were collected by F. de Quervain. L. J. S.

Chi (Y. S.). *Bibliography of Chinese geology for the years 1936–1940.* Pehpei, Chungking (Nat. Geol. Surv. China), 1942, vi+147 pp.

An author index, alphabetically arranged, consisting of 1796 titles. Approximately 1000 of these are in Chinese characters, with only the authors' names in Latin orthography. C. F. D.

Hall (A. L.). *A subject index to the literature of the South African geology and mineral resources for the years 1921 to 1935* (*inclusive*). Mem. Geol. Survey, South Africa, 1939, no. 37, 288 pp. Price 7*s.* 6*d.*

This is a companion volume to memoirs 25, 27, and 30 (authors' index) and a continuation of memoir 22. Subjects arranged alphabetically. [M.A. **2**–99, 481; **4**–51; **5**–250; **8**–150.] E. D. M.

Dresser (John A.) & Denis (T. C.). *La géologie de Québec. Vol. I. Bibliographie et index.—Geology of Quebec. Vol. I. Bibliography and index.* Province de Québec, Canada, Service des Mines, 1941 (Rapport géologique 20), 180 pp. *Partie I. Bibliographie par auteurs.—Part I. Bibliography by authors* (pp. 7–113). *Partie II. Index des sujets.—Part II. Subject index* (pp. 115–180). Price $1.00.

A compilation of 2351 titles, taken mainly from the 'Bibliography of North American geology' of the U.S. Geol. Survey [M.A. **7**–323], from the earliest records to 1936 inclusive. A supplement to the bibliography and two further volumes of the series, on geology and mineral deposits, are in preparation.

M. A. P.

Wilson (Eldred D.). *Bibliography of the geology and mineral resources of Arizona.* Bull. Arizona Bureau of Mines, 1939, no. 146 (Geol. Ser. no. 13) = Bull. Univ. Arizona, vol. 10, no. 2, 164 pp. Price 35 cents.

An alphabetically arranged bibliography and subject index of about 1750 items. C. F. D.

Publications on the geology, mineral resources, and mineral industries of Illinois. State Geol. Surv., Urbana, Illinois, 1941, 102 pp.

Publications of the State Geological Survey, U.S. Bureau of Mines, and the U.S. Geological Survey are listed separately, followed by miscellaneous publications arranged under years. A detailed index of authors, subjects, and counties is added. L. J. S.

Roberts (Joseph K.). *Annotated geological bibliography of Virginia.* Charlottesville, Virginia (Alderman Library), 1942, xi + 726 pp.

An author list of 2567 titles accompanied by a full abstract of each paper, followed by a subject index. Biographical sketches are given of Virginia geologists. L. J. S.

Singewald (Joseph T.). *Bibliography of economic geology of South America.* Special Papers, Geol. Soc. Amer., 1943, no. 50, 159 pp.

Author catalogues arranged under each country. L. J. S.

Lambert (Roger) & Aznárez (Jorge). *Bibliographie géologique de la république orientale de l'Uruguay.* Bol. Inst. Geol. Uruguay, 1939, no. 26, 79 pp.

Approximately 300 papers are listed under authors' names, alphabetically arranged. Brief summaries are given of some of the more important works. C. F. D.

Artificial Minerals

Jensen (Einar). *Pyrrhotite: melting relations and composition.* Amer. Journ. Sci., 1942, vol. 240, pp. 695–709, 5 figs.

The melting relations in the system Fe–S in the neighbourhood of pyrrhotine were determined in sealed tubes by heating and cooling curves. FeS melts over a wide (100°) interval with dissociation into a solid richer in sulphur and a liquid richer in iron. With increasing sulphur the melting-point rises to a maximum at $Fe_{12}S_{13}$ = $FeS_{1{\cdot}08}$(Fe 61·7 %) which melts sharply like a simple compound at 190° C. Mixtures with more iron than in FeS show eutectic melting. [M.A. 5–466; 7–143, 483.] L. J. S.

Lapin (V. V.) Лапин (В.В.). *Cuspidine and villiaumite in welding slag.* Compt. Rend. (Doklady) Acad. Sci. URSS, 1941, vol. 31, pp. 694–696, 1 fig.

The welding flux consisted of fluorite, chalk, and sodium silicate, and yielded a slag (analysis given) containing cuspidine (α 1·592, β 1·595, γ 1·606, 2V 63°, positive, $\gamma : c = 6°$) and fluorite, with villiaumite (n 1·333), perovskite, and chromospinel. Cuspidine has not hitherto been obtained artificially. Optical data are given for the several minerals. M. H. H.

LAUBENGAYER (A. W.) & WEISZ (R. S.). *A hydrothermal study of equilibrium in the system alumina–water.* Journ. Amer. Chem. Soc., 1943, vol. 65, pp 247–250, 2 figs.

The materials used in the experiments were prepared as follows: an aluminate solution precipitated with CO_2 at room-temperature gave bayerite, and at 100° gave gibbsite; gibbsite heated with water in a bomb at 350° gave böhmite, and at 450° well-formed crystals of corundum; γ-alumina was obtained by heating gibbsite; natural diaspore was used. Diaspore could only be obtained by seeding γ-alumina seeded with diaspore when heated with water at 430° (240 atmos.) was completely transformed into diaspore. A trial of the several method previously described for the formation of diaspore gave only böhmite. These materials were heated with water in a bomb at 100–500° and the products determined by optical and X-ray methods. Corundum is the stable phase above 450°, and γ-alumina is metastable throughout; the stability range of böhmite is 155–280°, and of diaspore 280–450°; gibbsite and bayerite are unstable above 155°. L. J. S.

WEISER (Harry B.), MILLIGAN (W. O.), & COOK (E. L.). *X-ray studies on the hydrous oxides. X. Anatase and rutile modifications of titania.* Journ Physical Chem., 1941, vol. 45, pp. 1227–1234, 8 figs.

Anatase is formed by hydrolysis of $Ti(NO_3)_4$ or $TiCl_4$ in the presence of HNO_3 or HCl, but it is soon transformed into the less soluble and more stable rutile at 100° C. or in the presence of an excess of acid; the transformation is slowed down in the presence of alkali chloride or nitrate. When formed by electrolysis of $Ti(SO_4)_2$ it is not easily transformed, even in the presence of concentrated H_2SO_4. L. J. S.

GELLER (R. F.). *A resistor furnace, with some preliminary results up to 2,000° C.* Journ. Research National Bureau Standards, U.S.A., 1941, vol. 27, pp. 555–566, 5 figs. (Research Paper 1443.)

Electric furnaces with Pt-Rh wire winding give temperatures up to 1600° C. and the atmosphere must be reducing. By using resistors of ThO_2 85, Yt_2O_3 15 %, with contact blocks of $ZrO_2 + Yt_2O_3$ to the Pt-Rh conductor, temperatures up to 2000° C. are attained in an oxidizing atmosphere. A supplementary Pt-Rh winding brings the ThO_2-Yt_2O_3 resistor up to the conducting temperature. The effect of heating shapes of Al_2O_3, BeO, CeO_2, MgO, ThO_2, and ZrO_2, either alone or in contact, are described. ThO_2 after heating to 2000° C. is face-centred cubic with a 5·57 Å.; with some ZrO_2 in solid solution a 5·53 Å. Mixtures of MgO and Al_2O_3 gave spinel and periclase. Mixtures of BeO and Al_2O_3 gave platy crystals of chrysoberyl (α 1·732, γ 1·741, melting-point between 1855° and 1880° C.) and bromellite (BeO). L. J. S.

WEISER (Harry B.), MILLIGAN (W. O.), & COOK (E. L.). *Hydrous cupric hydroxide and basic cupric sulfates.* Journ. Amer. Chem. Soc., 1942, vol. 64, pp. 503–508, 6 figs.

X-ray and dehydration data show that $Cu(OH)_2$ is the only compound in the system CuO–H_2O. This decomposes to brownish-black CuO. It is precipitated

m solutions in equivalent proportions of $CuSO_4$ and alkali or with excess of ali. From solutions with $CuSO_4$: alkali = 1·25 the precipitate has the nposition $5CuO.SO_3.xH_2O$, and with 1·33 or more then $4CuO.SO_3.3H_2O$ ochantite). With intermediate proportions mixtures of these are precipitated. .A. 4–306, 7–474.] L. J. S.

HAACKE (Ingeburg). *Über einen bemerkenswerten Magnetitzwilling in einer spätmittelalterlichen Schlacke.* Zentralblatt Min., Abt. A, 1940, pp. 73–78, 3 figs.

A section of a 15th-century slag consisting of dendritic magnetite in fayalite, m Hollingstedt in Schleswig-Holstein, shows a small six-rayed star of magnetite. is is interpreted as interpenetrating cubes twinned on (111) and with the tion plane parallel to (111). L. J. S.

GILL (W.). *Notes on the preparation and properties of some synthetic spinels.* First Report on Refractory materials, Iron & Steel Inst., London, 1939, pp. 201–204.

In connexion with problems of chrome-magnesite refractory bricks, the lowing spinels were prepared by sintering at 1550° C. the mixed oxides with % B_2O_3.

		Sp. gr.	*n*.	m.p.
Spinel	$MgAl_2O_4$	3·548, 3·545	1·72	> 1780° C.
Picrochromite	$MgCr_2O_4$	4·392, 4·395	1·90	> 1770
Chromite	$FeCr_2O_4$	5·221	2·12	> 1780
Magnesioferrite	$MgFe_2O_4$	4·201	2·35	1580–1610
Hercynite	$FeAl_2O_4$	—	1·80	—

The picrochromite is reddish-grey in artificial light and light green in daylight; gnesioferrite reddish-brown in artificial light and purplish-brown in daylight. gnesioferrite is strongly magnetic. L. J. S.

HN (Paul) & KLEMENT (Robert). *Isomorphe Apatitarten.* Zeits. Elektrochem. angew. physik. Chem., 1942, vol. 48, pp. 331–333.

Various substances with the apatite structure were obtained by sintering at 00° mixtures of $Ca_3(PO_4)_2$, Ca_2SiO_4, $CaSO_4$, CaF_2, and Na_2SO_4. P may be rtly or wholly replaced by Si and/or S. If $SiO_4'''' + SO_4''$ replaces $2PO_4'''$ no ange of cation is necessary, but otherwise the charges must be equalized by rtial replacement of Ca'' by Na', e.g. Na-Ca-sulphate-apatite $Na_6Ca_4(SO_4)_6F_2$. e corresponding hydroxy-apatites (except Na-Ca-sulphate-apatite) were also epared in the presence of water vapour. [M.A. 7–351, 475.] L. J. S.

EMENT (Robert), HÜTER (Friedrich), & KÖHRER (Kurt). *Bildet sich Carbonat-apatit in wässigen Systemen?* Zeits. Elektrochem. angew. physik. Chem., 1942, vol. 48, pp. 334–336.

Precipitates from phosphate and calcium salt solutions in the presence of rbonate contain only hydroxy-apatite and $CaCO_3$ in various proportions. rbonate-apatite $Ca_{10}(PO_4)_6CO_3$ was not formed. [M.A. 7–553.] L. J. S.

Ingerson (Earl) & Morey (George W.). *Preparation and properties of some compounds in the system H_2O–Na_2O–P_2O_5.* Amer. Min., 1943, vol. 28, pp. 448–455.

Optical data, some new determinations and others collected from the literature are given for about 20 sodium phosphates, both hydrous and anhydrous. Crystallographic and density data are given for some. Refractive indices are given for glasses $NaPO_3$–$Na_4P_2O_7$. L. J. S.

Guérin (Henri). *Sur les arséniates alcalino-terreux, étude du système As_2O_5–OCa–OH_2.* Ann. Chim. Paris, 1941, sér. 11, vol. 16, pp. 101–153, 2 pls. text-figs.

Nine different compounds were prepared at temperatures 17–90°, and optical data are given. The unstable $CaHAsO_4.3H_2O$, prepared by the action of As_2O_5 on $Ca(OH)_2$ or $CaCO_3$ in water, is transformed to pharmacolite ($CaHAsO_4.2H_2O$) or haidingerite ($CaHAsO_4.H_2O$) according to whether the *p*H of the liquid is $>$ or $<$ 6. L. J. S.

Shand (S. J.). *Notes on cordierite: (A) cordierite crystals from a glass furnace; (B) cordierite from Horns Nek, Transvaal.* Amer. Min., 1943, vol. 28, pp. 391–395.

A crust on the wall of a glass furnace tank consists of water-clear composite hexagonal prisms 2–5 mm. long with α 1·5223, γ 1·5270, 2V 82–83°, negative, sp. gr. (D_4^{19}) 2·516, and analysis, SiO_2 50·77, Al_2O_3 35·26, MgO 12·72, CaO 1·24, H_2O 0·25 = 100·24, corresponds with $2(Mg,Ca)O.2Al_2O_3.5SiO_2$. A rock from Horns Nek, which had been described as 'nepheline granophyre' contains twinned hexagonal grains ($\frac{1}{2}$ mm.) with quartz, hypersthene, &c.; these crystals which had been thought to be nepheline are actually cordierite with 2V 70°, negative, and the rock appears to be a cordierite-hypersthene-hornstone. L. J. S.

Phemister (J.). *Note on fused spent shale from a retort at Pumpherston, Midlothian.* Trans. Geol. Soc. Glasgow, 1942, vol. 20, pp. 238–247, 1 pl.

A petrographical description of various rocks from a Scottish oil-shale retort. Slag (= fused shale) contains cordierite prisms (α 1·543, γ 1·553, negative), bytownite, ferrohortonolite (2V 61°, negative), pyroxene (about $Di_{50}He_{50}$), spinellid, and glass. Cordierite is developed within fragments of unfused laminated shale in the slag; in a cordierite-glass corona around these fragments; in holocrystalline slag; and in a cordierite-glass zone along a firebrick-slag contact. Comparable rocks of natural occurrence are noted. C. F. D.

Grigoriev (D. P.) & Lebedeva (O. N.) Григорьев (Д. П.) и Лебедева (О.Н.). *On the products of fusing hornblende with fluoride additions.* Compt. Rend. (Doklady) Acad. Sci. URSS, 1941, vol. 31, pp. 787–790, 1 fig.

Amphibole fused with 10 % of NH_4F yielded a mixture of phlogopite with calcium fluosilicate and a little amphibole and magnetite. Two types of regular growth of amphibole on mica are noted. M. H. H.

Belyankin (D. S.) & Ivanov (B. V.)] Белянкин (Д. С.) и Иванов (Б. В.) Beliankin (D. S.) and Ivanov (B. V.). *On the question of the relations of clinoenstatite to enstatite and diopside.* Compt. Rend. (Doklady) Acad. Sci. URSS, 1941, vol. 30, pp. 647–648.

At the contact of Dinas brick and magnesite in an open-hearth furnace was ormed a layer several cm. thick consisting of large skeletal crystals of clino- nstatite, the spaces between the crystal branches being filled with a more finely rystallized mixture of augite, cristobalite, and magnetite. The branches of the linoenstatite (α 1·651, γ 1·662, $\gamma : c = 21\frac{1}{2}°$, 2V 44°, optic axial plane $\perp$ (010)) re overgrown with shells of enstatite-diopside (α 1·658, γ 1·686, $\gamma : c = 35–44°$ ncreasing from the interior to the exterior, 2V 0°), the two being in parallel rystallographic position but sharply separated. The enstatite-diopside grades utwards into a yellow-green augite (α 1·702, γ 1·742, $\gamma : c = 49–52°$, 2V 68–82° ncreasing towards the exterior, optic axial plane (010)) of much the same character s the augite in the interspaces of the skeletal crystals. The case is similar to the helly growth of orthoclase on plagioclase, and the growth of non-homogeneous rystals must be connected with changes of temperature. L. J. S.

Belyankin (D. S.) & Lapin (V. V.)] Белянкин (Д. С.) и Лапин (В. В.) Beliankin (D. S.) and Lapin (V. V.). *Some features of the crystalline structure of the Ural highly argillaceous blast-furnace slags.* Compt. Rend. (Doklady) Acad. Sci. URSS, 1942, vol. 35, pp. 25–30, 1 fig.

Slags (used for cement) containing SiO_2 4–6, Al_2O_3 44–55, CaO 37–45 %, ith small amounts of Fe_2O_3 and TiO_2, consist of $CaAl_2O_4$, $Ca_5Al_6O_{14}$, Ca_2SiO_4 ? larnite], and $Ca_2Al_2SiO_7$ (gehlenite). $CaAl_2O_4$ occurs as phenocrysts and in the roundmass. The order of crystallization and the proportions of the constituents o not agree with the $CaO–Al_2O_3–SiO_2$ diagram of Rankin and Wright [M.A. –320]. L. J. S.

Runer (John W.). *Conditions for the formation of paragonite.* Amer. Min., 1942, vol. 27, pp. 131–134.

Artificial paragonite produced by heating bayerite, silica, and sodium chloride n N/10 HCl solution in a gold-lined bomb for seven days gives an X-ray powder attern close to that of muscovite but with spacings *b* 8·90, *c* 19·33 ± 0·02 Å. ines due to boehmite are also observed. The smaller Na ion replaces K in uscovite to give a less stable structure. Hence the comparative rarity of natural aragonite. F. A. B.

chairer (J. F.) & Bowen (N. L.). *The binary system $CaSiO_3$–diopside and the relations between $CaSiO_3$ and akermanite.* Amer. Journ. Sci., 1942, vol. 240, pp. 725–742, 6 figs.

Equilibrium diagrams are given for the systems $CaSiO_3$–diopside ($CaMgSi_2O_6$) nd $CaSiO_3$–åkermanite ($Ca_2MgSi_2O_7$), and parts of the system CaO–MgO–FeO– iO_2 are reviewed [M.A. **8**–258]. The inversion temperature of wollastonite to seudowollastonite is raised from 1125° to 1368° C. by the solid solution of 21 % iopside. There is no solid solution of diopside in pseudowollastonite nor of

$CaSiO_3$ in diopside. Åkermanite is unstable below 1325° C. and the system ceases to be binary. There is no solid solution of åkermanite in wollastonite or pseudowollastonite. L. J. S.

Osborn (E. F.). *The system $CaSiO_3$–diopside–anorthite.* Amer. Journ. Sci., 1942, vol. 240, pp. 751–788, 15 figs.

This is another portion of the system CaO–MgO–Al_2O_3–SiO_2 [M.A. 8–258]. An equilibrium diagram is given of the ternary system and some new data for the binary systems $CaSiO_3$–anorthite and diopside–anorthite. The diopside is slightly aluminous and is not compatible with pseudowollastonite under equilibrium conditions. Wollastonite solid solutions on cooling show exsolution of diopside and approach pure $CaSiO_3$. There is no evidence for the existence of a compound $5CaO.2MgO.6SiO_2$ [M.A. 1–322]. L. J. S.

Snow (R. B.) & McCaughey (W. J.). *Equilibrium studies in the system FeO–Al_2O_3–SiO_2.* Journ. Amer. Ceramic Soc., 1942, vol. 25, pp. 151–160, 5 figs.

The crystal phases which separate from melts in this system are fayalite, hercynite, tridymite and cristobalite, mullite, corundum, and wüstite. No evidence for the existence of an iron pyroxene or a ternary compound in equilibrium with liquid was found. Fayalite and mullite are incompatible, forming on mutual fluxing hercynite + tridymite ± corundum. [M.A. 7–480.] C. F. D.

Schairer (J. F.). *The system CaO–FeO–Al_2O_3–SiO_2: I, results of quenching experiments on five joins.* Journ. Amer. Ceramic Soc., 1942, vol. 25, pp. 241–274, 12 figs.

Liquidus data are given for the following five planes within the CaO–FeO–Al_2O_3–SiO_2 tetrahedron used to represent phase relations in that quaternary system: SiO_2–anorthite–FeO, anorthite–Al_2O_3–FeO, $CaSiO_3$–anorthite–FeO, gehlenite–anorthite–FeO, and $CaSiO_3$–gehlenite–FeO. An equilibrium diagram for the ternary system FeO–Al_2O_3–SiO_2 is also presented [cf. preceding abstract]. Observations of petrological interest are made on the direction of change of composition of the liquid phase during crystallization, and on the incompatibility of certain solid phases. C. F. D.

Hatch (Robert A.). *Phase equilibrium of the system $Li_2O.Al_2O_3$–SiO_2.* Amer. Min., 1943, vol. 28, pp. 471–496, 4 figs.

Mixtures of $Li_2O.Al_2O_3$ with 22–85 % SiO_2 were fused and the liquidus and solidus temperatures determined. The diagram shows five (or six) fields: (1) silica; (2) solid solution of the high-temperature β-spodumene ($Li_2O.Al_2O_3.4SiO_2$, tetragonal) and silica; (3) solid solution of β-spodumene with β-eucryptite; (4) solid solution of β-eucryptite ($Li_2O.Al_2O_3.2SiO_2$, probably tetragonal) with β-spodumene; (5) γ-alumina; (6) lithium aluminate (?). Optical data and melting-points are given. Petalite ($Li_2O.Al_2O_3.8SiO_2$) and 'lithium orthoclase' ($Li_2O.Al_2O_3.6SiO_2$) were not observed. Attempts to prepare the mineral α-spodumene hydrothermally resulted only in β-spodumene. L. J. S.

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